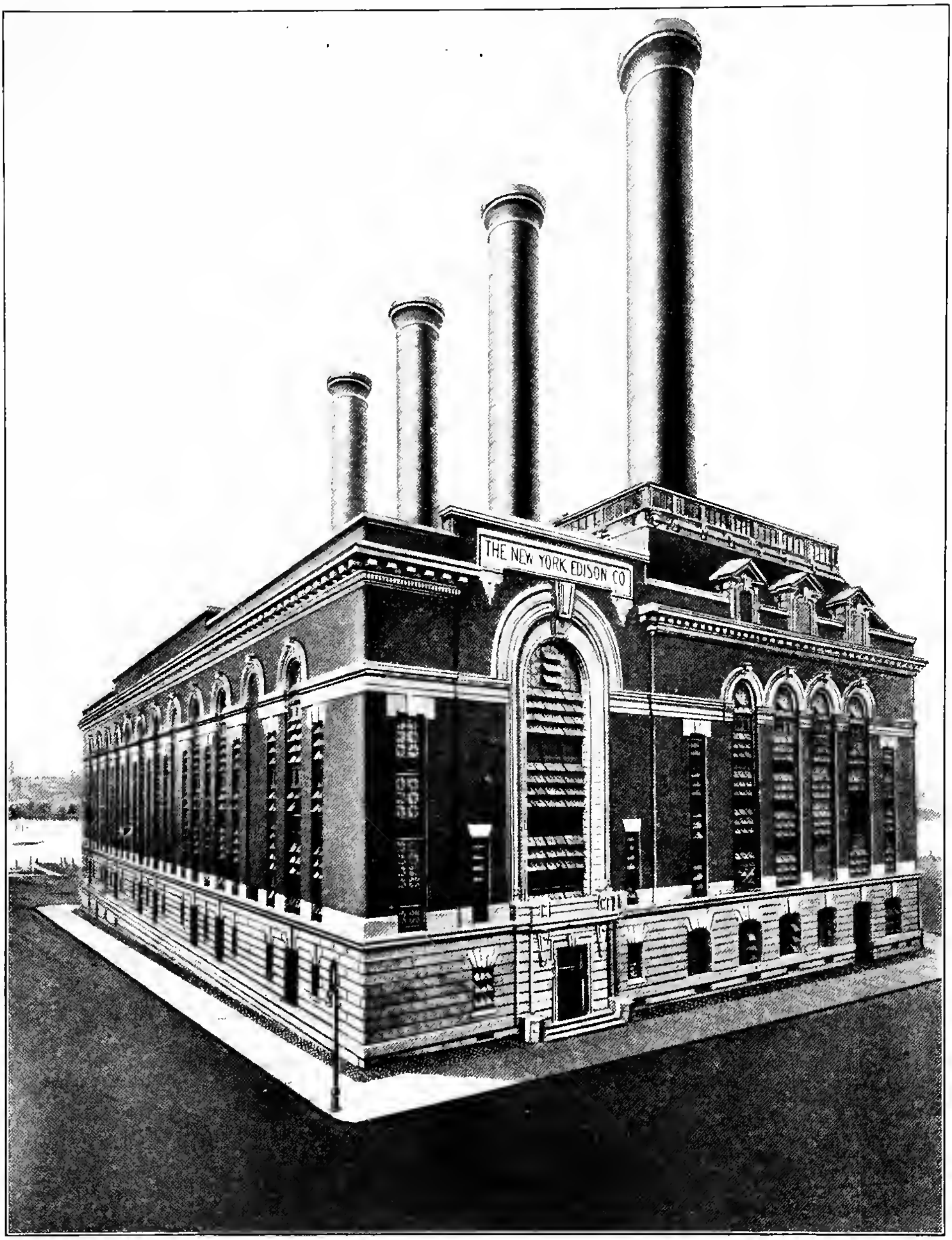

WATERSIDE No. 2 POWER HOUSE

SPECIFICATIONS

FOR THE

New Waterside Power House

OF THE

NEW YORK EDISON COMPANY

New York, July 1907

THE NEW YORK EDISON COMPANY

LIST OF CONTRACTORS

BULKHEAD

PHOENIX CONSTRUCTION & SUPPLY CO.

FOUNDATIONS

ISAAC A. HOPPER & SON

STRUCTURAL STEEL

POST & McCORD, INC.

SUPERSTRUCTURE

MURPHY CONSTRUCTION COMPANY

COAL AND ASH HANDLING MACHINERY

MEAD MORRISON MFG. CO.

CRANES

CASE MANUFACTURING COMPANY
MANNING, MAXWELL & MOORE, INC.

BOILERS AND SUPERHEATERS

BABCOCK & WILCOX COMPANY

BOILER FRONTS

BABCOCK & WILCOX COMPANY   EDWIN BURHORN

GRATES

M. H. TREADWELL & COMPANY
NEEMES BROTHERS   WASHBURN & GRANGER

ECONOMIZERS

B. F. STURTEVANT COMPANY

FORCED DRAFT

B. F. STURTEVANT COMPANY

COAL DOWNTAKES

EDWIN BURHORN

FEED PUMPS

BUFFALO FORGE COMPANY   D'OLIER ENGINEERING CO.
PLATT IRON WORKS COMPANY

HEATERS

PLATT IRON WORKS COMPANY

TURBO GENERATORS

GENERAL ELECTRIC COMPANY
WESTINGHOUSE ELECTRIC & MFG. CO.

CONDENSERS

ALBERGER CONDENSER CO.   HENRY R. WORTHINGTON, INC.
WHEELER CONDENSER & ENGINEERING CO.

ELECTRICAL EQUIPMENT

GENERAL ELECTRIC COMPANY
WESTINGHOUSE ELECTRIC & MFG. CO.

STORAGE BATTERIES

ELECTRIC STORAGE BATTERY CO.

PREFACE

These specifications are intended to cover in a general way the construction contracts of the New Waterside, now known as the Waterside No. 2 power house, although the general clauses have been omitted in order to save space.

It was thought advisable in the design of the station to provide for either vertical reciprocating engines or for either or both of two types of steam turbine units of the maximum sizes then developed, thus necessitating a compromise between the demands of the various designs; and the operating room was laid out to contain twelve 6,000 k. w. vertical engines, or sixteen 5,000 k. w. vertical turbine units, or twelve 5,500 k. w. horizontal turbine units. Further developments in the turbine field and certain operating conditions have determined the final layout.

In the design and construction of the station The New York Edison Company has been represented by J. W. Lieb, Jr., Associate General Manager, J. P. Sparrow, Chief Engineer, P. Torchio, Chief Electrical Engineer, G. A. Orrok, Mechanical Engineer, E. M. Van Norden, Civil Engineer, W. W. Erwin, Superintendent of Construction, H. Stephenson, Superintendent of Distribution and C. B. Grady, Resident Engineer.

THOMAS E. MURRAY,
General Manager.

New York, July, 1907.

SPECIFICATIONS

Accompanied by drawings for the

BULKHEAD AND CONDENSING WATER TUNNELS

of the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. being a part of the contract dated April 10, 1905, between the Phoenix Construction and Supply Company, Contractors, and The New York Edison Company.

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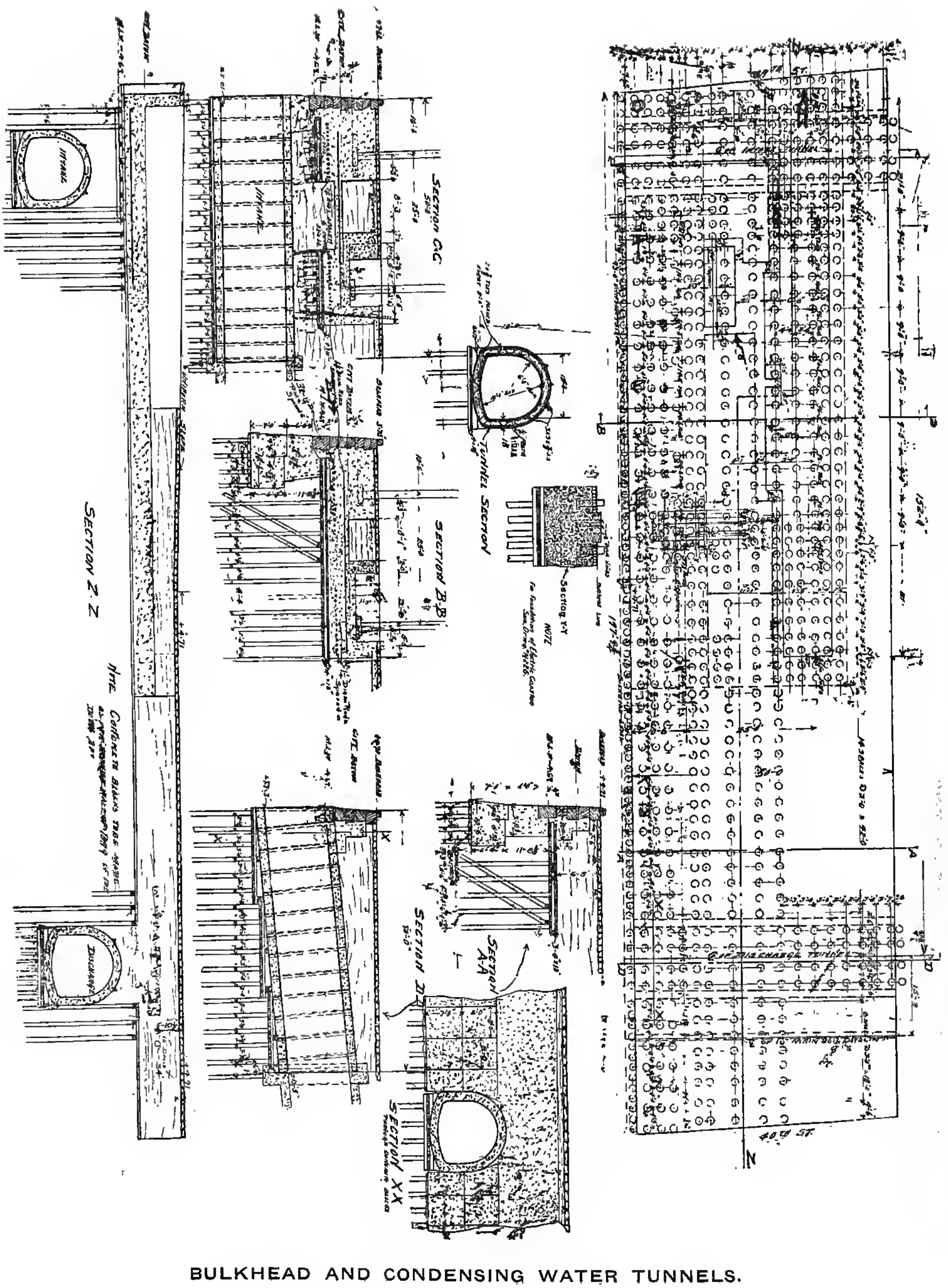
1. General Description of the Work:

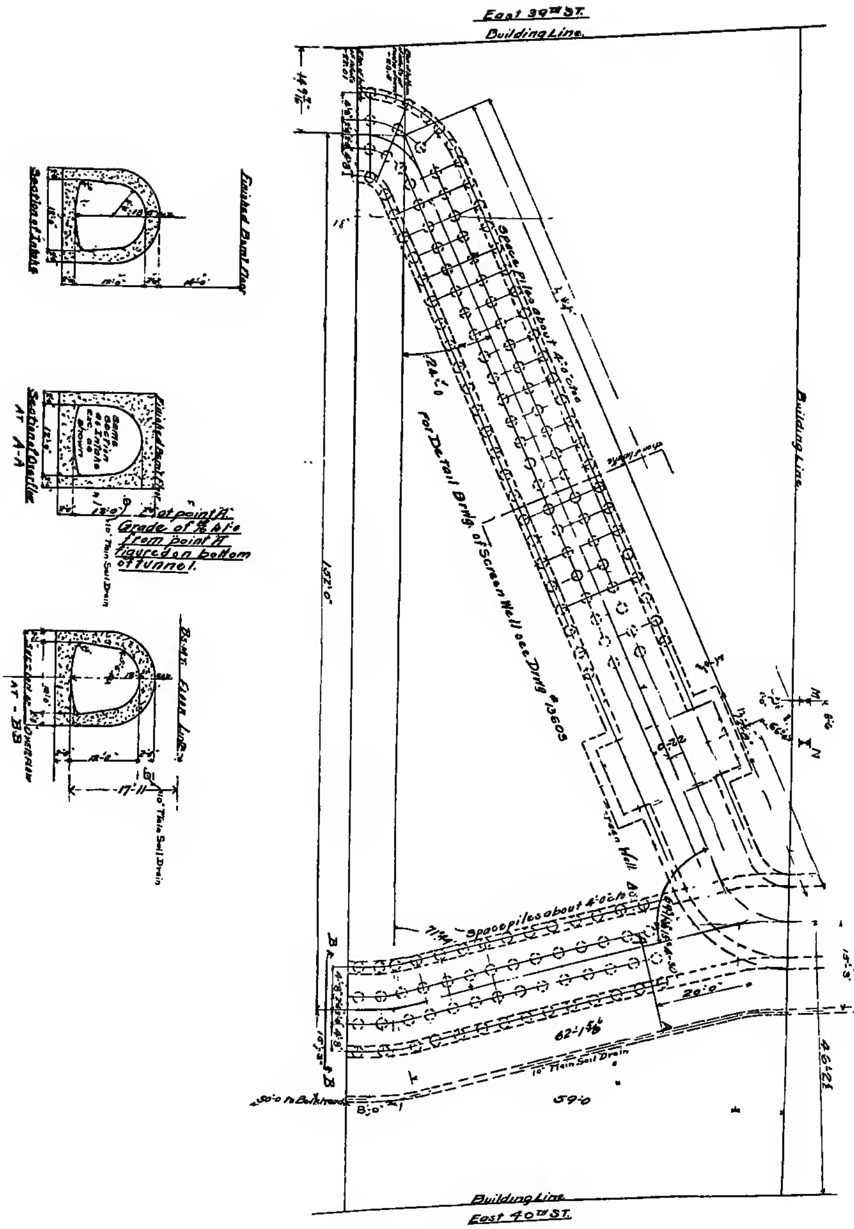
The work to be done under this contract consists of the removal of the old crib bulkhead between 39th and 40th streets and the construction of the new bulkhead, the foundations for the coal towers and ash pockets, and the condensing water tunnels, all on the area bounded by 39th and 40th streets and a line 50 feet from the bulkhead line and the East River.

The foundations for the coal towers and ash pockets occupy a space approximately 42 feet by 110 feet in the southeast portion of the above area.

The center lines of the intake and discharge tunnels are perpendicular to the bulkhead line, being 152 feet center to center. The center line of the intake tunnel is 12 feet from the intersection



BULKHEAD AND CONDENSING WATER TUNNELS.



PLAN OF CONDENSING WATER TUNNELS.

of the bulkhead line and the north line of 39th street, measured along the bulkhead.

The Standard Bulkhead of the Dock Department is to be used, modified only where made necessary by the foundation for the coal towers and ash pockets or by the condensing water tunnels.

2. Foundations for Coal Towers and Ash Pockets:

The foundations for the coal towers and ash pockets are to be of the dimensions shown on the drawing and are to be made of one, three, five, concrete reinforced by steel rods where they extend over the top of the intake tunnel. 1¼″ steel rods spaced 1′ 0″ center to center along the bulkhead are to be placed the entire length of the foundation to tie the two rows of columns together.

3. Condensing Water Tunnels:

The Contractor is to do all excavating, pumping, steel and concrete work necessary for the installation of that portion of the condensing water tunnels between the bulkhead and the line 50 feet from it above mentioned. As shown on drawing No. 12815, these tunnels are both made of an outer and inner shell of ¼″ steel conforming to the general section of the tunnel as nearly as possible. These shells are to be securely fastened together by means of lacing bars and the space between them filled with one, three, five concrete.

They are to be sunk to position on the yellow pine grillages as shown on drawing and rip-rap is to be placed on either side extending from the crown of the arch at a slope of 1½ horizontal to 1 vertical.

4. Earth Excavation and Dredging:

The Contractor is to do all necessary excavating and dredging in connection with this work. The Contractor is to provide sheet piling for the support of the faces wherever necessary or

where required by the Engineer and such back-filling as is necessary or is shown on the plans.

5. PILING:

The greater part of the entire area is to be piled as shown on drawing No. 12815. All piles are to be of straight, sound, live timber, free from cracks, shakes and rotten knots. Piles are to be of red or yellow pine and all loose bark must be removed to the low water line. The piles must show an even and gradual taper from end to end. All piles must not be less than 14 inches diameter at the butt and not less than 6 inches at the point.

The small end is to be sharpened for driving and the butt is to be banded with an iron band during driving. All piles are to be driven until, with a 3000 pound hammer falling ten feet, the total penetration of the last three blows does not exceed 2 inches, or until, in the judgment of the Engineer, a sufficient depth has been attained. The piles must be accurately centred and driven plumb, but if, driven out of centre, or if not driven straight. the Contractor, at the discretion of the Engineer, may be required to draw the piles and redrive them properly.

When piling near present bulkheads, a close watch must be kept that their foundations are not disturbed by the compression of the neighboring sub-soil, and the Contractor is to assume full responsibility for the stability and alignment of these structures.

Piles may be cut off to grade as soon as the piledriver is working more than 25 feet from the line of completed piling, but in no case shall any pile be cut to grade until all chance of liability to disturbance has ceased.

6. TIMBER:

All timber is to be yellow pine free from cracks, shakes and rotten knots.

The grillages are to be made of three layers of 4" x 10" timbers securely spiked together. When the piles are cut to grade,

these grillages are to be floated into position and securely fastened to the tops of the piles.

7. CONCRETE:

The concrete used for making the concrete blocks forming part of the sea-wall is to be composed by measure, of one part cement, two parts sand and five parts of broken lime or bluestone chips or gravel. All other concrete is to be composed by measure of one part cement, three parts sand and five parts of broken lime or bluestone chips or gravel. The cement will be furnished to the Contractor by the Company at the uniform rate of $1.50 per barrel plus 10c. for each bag with a rebate of 10c. for each bag returned.

All broken stone shall pass in every way through a ring two inches in diameter, and it shall be screened and washed clean. If gravel is used, the fine gravel (over ⅛″) is to be left in, but the gravel is to be washed free from loam and clay.

The cement and sand shall be thoroughly mixed dry, the proper quantity of clean water shall then be sprayed on the mixture, the clean moistened stone shall then be added to the mass and the whole thoroughly mixed. The amount of water added shall be as determined by the Engineer. All concrete shall be thoroughly rammed in place before the cement has begun to set. The mixing of the concrete is to be done by a mixing machine whenever possible, or as directed by the Engineer. The broken stone shall be wetted down before mixing with the mortar and all materials are to be measured in bulk. Whenever a mixing machine is not used, the concrete is to be mixed on plank platforms in small and convenient quantities and immediately deposited in the work. It shall be laid in sections and in horizontal layers not exceeding nine inches in thickness and must all be thoroughly rammed. In no case is any concrete to remain in the work if it has begun to set before ramming of same is completed. All plank and timber curbs to confine the concrete in the shape and dimensions called for by the drawings are to be furnished by the Contractor. Before any weight is placed on the

concrete, it must have as much time to set as can be conveniently allowed, and in no case less than 24 hours. In cold weather the concrete is to be heated as directed by the Engineer. All water used in making concrete and mortars must be fresh and clean; salt water is not to be employed.

The bottoms of the steel grillages for the line of columns farthest from the bulkhead will be set exactly on the datum line. The bottoms of the steel grillages for the line of columns nearest the bulkhead are to be set 2′ 9″ above the datum line. The Contractor is to finish off that portion of the foundation ¾ of an inch below the points above mentioned and wait until the grillages and the first length of column are set before finishing off the foundation to the grade line. The Contractor is to finish and pour the grout for setting the grillage beams.

8. Work Under Direction of the Dock Department:

The above mentioned work is to be done under the direction of the Dock Department and the Contractor is to furnish all drawings required by the Commissioner of Docks or his Engineer, and to secure all permits, etc., necessary for proceeding with the work.

Three prints of all such drawings are to be furnished by the Contractor for the use of the Company.

SPECIFICATIONS

Accompanied by drawings for the

GENERAL FOUNDATION WORK

of the New Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of Contract dated September 9, 1904, between Isaac A. Hopper & Son, Inc., Contractors, and the New York Edison Company.

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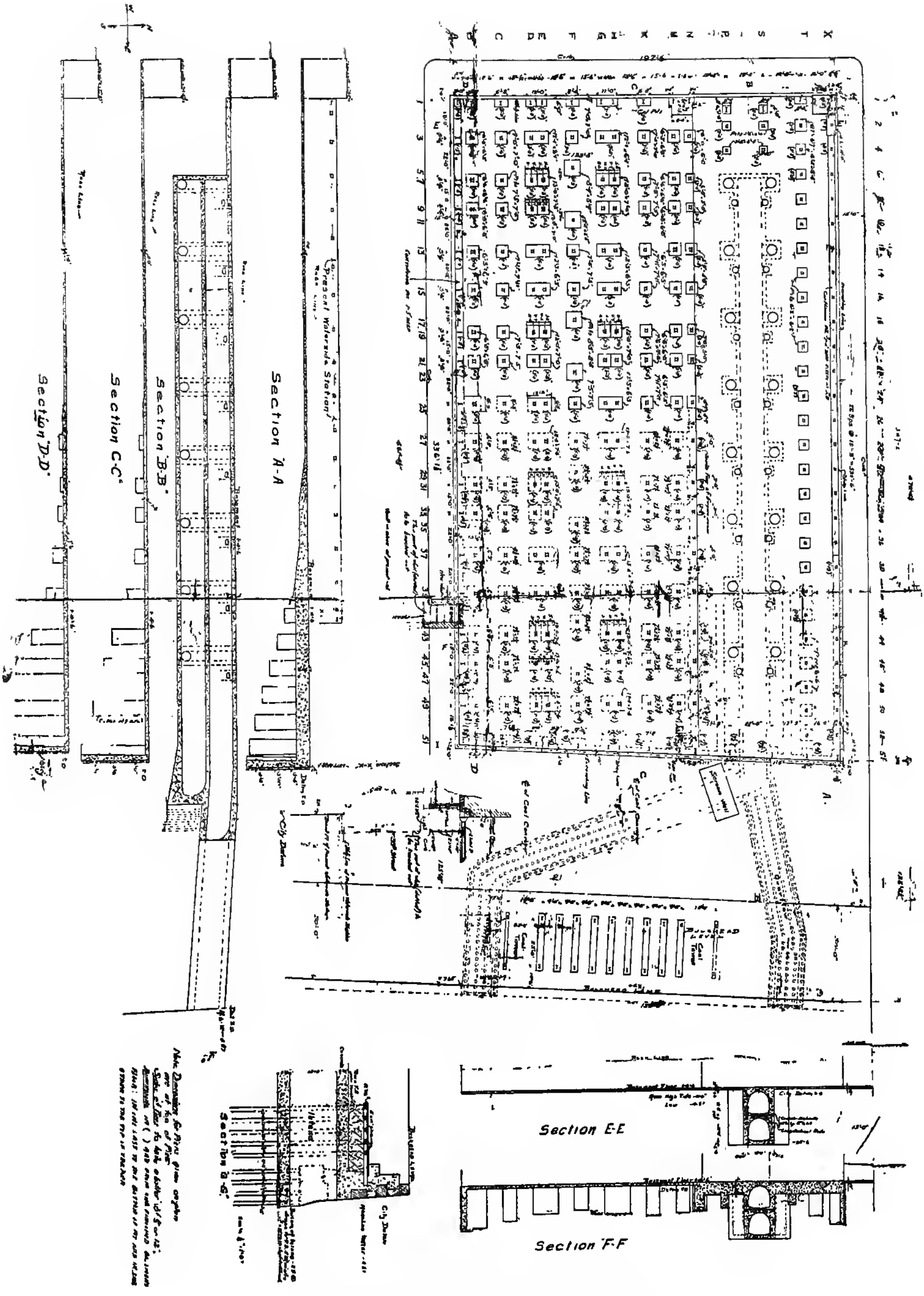
1. General Description of the Work:

The work to be done under this contract consists of the furnishing of all labor and materials required for the earth excavation, the rock excavation, the back filling, the piling, and the concrete work for a foundation of a power station, and two condensing water tunnels located on a piece of land bounded on the north by the south side of 40th street, on the south by the north side of 39th street, and on the west by the east side of 1st avenue and on the east by a line parallel to and at a distance of 50′ 0″ from the United States Bulkhead Line; for a vault along 1st avenue and 40th street; and a tunnel underneath 39th street, connecting the new power station with the coal handling vault adjacent to the present station. With the above works is to be included all sheet piling, pumping, coffer dams, caisons and all miscellaneous items that will be necessary in order that the work may



GENERAL FOUNDATION PLAN.

be properly performed. All work lying east of a line parallel to and at a distance of 50′ 0″ from the United States Bulkhead Line will be done under another contract.

The Building will be trapezoidal in shape, fronting on 1st avenue for a distance of 197′ 6″, extending back on 40th street a distance of 347′ 2″ and on 39th street a distance of 336′ 1⅞″. The building is divided into two parts, an engine room 73′ 10″ wide and a boiler room 119′ 8″ wide, the dividing line being parallel to 39th and 40th streets.

Starting from a point about 40′ 0″ from the west building line and running down the engine room, are to be two condensing water tunnels, one placed above the other, the upper one being the overflow tunnel and the lower one the inflow. The bottom of the upper tunnel is to be reinforced with steel, so that there will be no danger of the hot water from the overflow leaking through to the water in the inflow tunnel below.

2. THE BASEMENT FLOOR LINE:

The basement floor line will be at the same level for both the engine and boiler room floors, at a distance of 4′ 6″ above City Datum. City Datum is approximately 5′ 3″ above Mean Low Water. All earth and rock is to be excavated down to a level of 1′ 0″ below the basement floor level and where the steel grillages come, the rock is to be excavated down to a distance of 3′ 0″ below the basement floor, leaving 6″ as the minimum thickness of the concrete between the rock and the bottom of the steel grillages which will be 2′ 6″ below the basement floor line. At the east end of the building, concrete piers and walls are to be carried down to rock for supporting the columns and walls. The rock must be leveled off under piers and stepped off under wall foundations. After the piers and wall foundations have been put in place, the spaces between are to be filled in with good dirt or sand, well puddled down, up to a level of 1′ 6″ below the boiler room floor.

After the steel grillages have been set and grouted in place, the concrete for the floor of the engine room and boiler room is to be put in, up to within 1½″ of the level of the basement floor

line. The granolithic finish, 1½″ thick, will be supplied under another contract.

3. Earth Excavation and Back Filling:

The Contractor is to excavate the earth for the entire building, the vault on First avenue, the vault on 40th street, the condensing water tunnels to a line 50 feet from the bulkhead and the vault connecting the new station with the vault located on 39th street, adjacent to the old station. The removal of the old buildings, etc., located on the property is to be included in this contract, and all old foundations, pipe, loose rock, etc., that may be encountered, except solid rock, are to be taken out by the Contractor and shall be counted as earth excavation. All material excavated is to be carted away and disposed of at the Contractor's expense, except metal scraps, pipes, tanks, etc.; and such materials as may be required for back filling, which is to be good earth or sand, free from all rubbish. All back filling is to be done by the Contractor. The Contractor is to furnish and drive all sheet piling for the support of the faces wherever necessary or required by the Engineer.

4. Wrecking:

The Contractor is to tear down and remove all the buildings on the property. He is to take up all tanks, pipes, metal scrap, valves and other metal work buried in the ground; but the material so taken up is to remain the property of the Company and will be taken away from the building site by the Company. The materials of the buildings proper, such as brick, stone, roof trusses, windows, bluestone, flagging, etc., are to be the property of the Contractor and removed from the building site or otherwise disposed of at his expense. All machinery, piping, tanks or other iron work in the buildings at the present time will be removed by the Company prior to the time of starting work.

5. Rock Excavation:

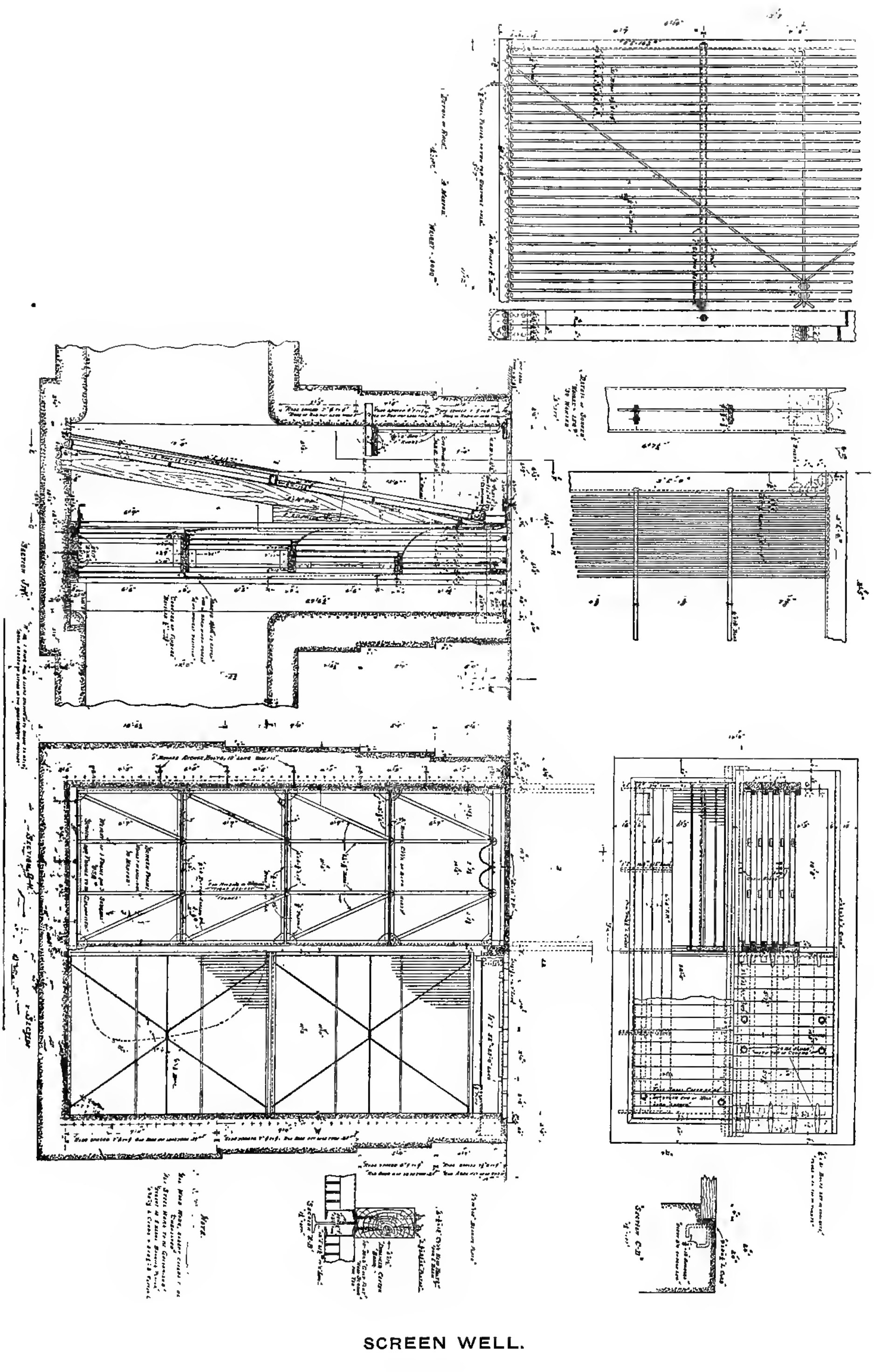
The Contractor is to do all the rock excavation required for the area covered by the building, the vault along First avenue and 40th street, the condensing water tunnels and the vault at 39th street. The rock excavation for the condensing water tunnels is to be done with the aid of a channeler to avoid shattering the rock adjacent to the excavation, and the Contractor is to take the utmost caution in using explosives and must comply strictly with all laws, ordinances, etc., in reference to the use of same. All rock excavated is to be carted away and disposed of by the Contractor.

6. Piling:

The Contractor is to furnish and drive all the piles shown on drawing No. 11162 for the condensing water overflow tunnel and such piles as may be required for the intake tunnel, within 50 feet of the bulkhead line. All piles are to be of straight, sound, live timber, free from all cracks, shakes and rotten knots. Piles may be of yellow or red pine, or spruce, and all loose bark must be removed. The piles must show an even and gradual taper from end to end. All piles must not be less than 14 inches diameter at the butt and not less than 9 inches at the point. The small end is to be sharpened for driving and the butt is to be banded with an iron band during driving. All piles are to be driven until, with a 2,000-pound hammer falling twenty feet, the total penetration of the last three blows does not exceed 2 inches, or until in the judgment of the Engineer a sufficient depth has been attained. The piles must be accurately centered and driven plumb, but if driven out of centre, or if not driven straight, the Contractor, at the discretion of the Engineer, may be required to draw the piles and redrive them properly.

7. Coffer Dams and Pumping:

The Contractor is to construct and maintain all the coffer dam construction that may be necessary in order that the con-



SCREEN WELL.

densing water tunnels, the piers for supporting the columns, the foundation footings for the wall and the screen well may be installed in a thoroughly strong and workmanlike manner.

All pumping that may be necessary to keep the excavation or coffer dams clear of water is to be done by the Contractor.

8. CONCRETE:

The Contractor is to furnish all the material and labor, including the necessary forms, for the concrete for the building up to a distance of 1½" below the basement floor line, the condensing water tunnels out to a line fifty feet from the bulkhead, the floor of the vaults along First avenue and 40th street, the piers for the supporting of the columns, the wall footings, and the vault connecting the new station with the old vault on 39th street.

The piers for supporting the columns and the footings below the walls are to be carried down to rock. The rock below all column piers is to be leveled off and that below the wall footings is to be stepped off, no step being less than 4' 0". Included with the condensing water intake tunnel, is to be a screen well complete in all details, except the iron screens themselves and the operating mechanism, as shown on drawing No. 11727.

The concrete for the piers supporting the columns and wall footings is to be composed by measure of one part cement, two and one-half parts sand and five parts of broken lime or blue stone chips or gravel.

All other concrete is to be composed by measure, of one part cement, three parts sand and five parts of broken lime or bluestone chips or gravel. The cement will be furnished to the Contractor by the Company.

All broken stone shall pass in every way through a ring two inches in diameter, and it shall be screened and washed clean. If gravel is used, the fine gravel (over ⅛") is to be left in but the gravel is to be washed clean of loam and clay.

The cement and sand shall be thoroughly mixed dry, the proper quantity of clean water shall then be mixed in and the clean, moistened stone shall then be added to the mass and the

whole thoroughly mixed. The amount of water added shall be such as to assume a monolithic mass of concrete. All concrete shall be thoroughly rammed in place before the cement has begun to set. The mixing of the concrete is to be done by a mixing machine whenever possible, or as directed by the Engineer. The broken stone shall be wetted down before mixing with the mortar and all materials are to be measured in bulk. Whenever a mixing machine is not used, the concrete is to be mixed on plank platforms in small and convenient quantities and immediately deposited in the work. It shall be laid in sections and in horizontal layers not exceeding nine inches in thickness and must all be thoroughly rammed. In no case is any concrete to remain in the work if it has begun to set before the ramming of same is completed. Plank and timber curbs must be furnished by the Contractor to confine the concrete in the shape and dimensions called for by the drawings. Before any weight is placed on the concrete, it must have as much time to set as can be conveniently allowed, and in no case less than 24 hours. In cold weather, the concrete is to be heated as directed by the Engineer. All water used in making concrete and mortars must be fresh and clean; salt water is not to be employed.

9. CEMENT:

All the cement to be used in this work will be furnished the Contractor by the Company in bags at a uniform rate of $1.50 per barrel plus 10 cents for each bag, with a rebate of 10 cents for each bag returned. The cement will be stored in a storehouse on the north side of 40th street, directly opposite the property and the Contractor will take the cement from this storehouse in such quantities and at such times as may be necessary for the prosecution of the work.

10. STEEL BEAMS AND RODS:

The Contractor is to furnish and set the steel rods for re-inforcing the bottom of the overflow tunnel. This re-inforcement is to consist of five rods, running the entire length of the tunnel

inside of the building, about 18″ below the bottom, and a system of cross rods, spaced 6″ centre to centre, each rod being 15′ 0″ long, located about 3″ above the longitudinal rods. All of the above rods are to be ½″ rods of medium steel, deformed in some manner satisfactory to the Engineer, so as to ensure a high elastic limit.

The Contractor is to furnish and set the steel beams that are built in the concrete for the screen well and is also to furnish and set the steel beams over vault at 39th street connecting to the old station.

The steel over the vault shall be painted one coat before and one after erection with red lead and linseed oil paint.

All other iron shall be painted with a shop coat of pure linseed oil and when put in place shall be painted with a mixture of water and neat Portland cement. The concrete or cement coating may then be placed around the beams.

11. Water-Proofing:

The Contractor is to furnish all labor and material for water proofing the vault on 39th street connecting to the old station. All water proofing is to consist of 4 layers of 3-ply roofing felt. laid in asphalt with joints lapped.

12. Floor Over Vault:

Over the vault on 39th street, the Contractor is to install a sidewalk construction of concrete re-inforced with metal, so designed that it will safely stand a load of 450 pounds per square foot.

13. Sidewalk Bridge:

The Contractor is to construct a substantial sidewalk bridge over the excavation for the vaults for the entire length of the building on First avenue and such portions of 40th street as may be necessary. The building of the retaining wall at the curb is not included in this contract.

14. FINISH OF FLOORS:

The Contractor is to slope and grade the floors for the engine room and boiler room so that they will properly drain, and is also to leave drainage trenches for drainage pipes, as directed by the Engineer. The Contractor is also to leave the necessary pits and trenches in the concrete forming the floors of the boiler house for the tracks and hoppers for the ash handling machinery, and is to furnish the mortar to properly grout the hopper and tracks.

15. BULKHEAD AND PORTIONS OF THE CONDENSING WATER TUNNELS TO BE DONE UNDER ANOTHER CONTRACT:

A new bulkhead is to be constructed along the United States Bulkhead Line, and this bulkhead, together with the foundations for an ash pocket and a coal tower and the portions of the condensing water tunnels that lie between the bulkhead line and a line 50 feet west of and parallel to said line, will be done under another contract. The above mentioned portions of the tunnels are to be completed first, and the Contractor is to make connection to said portions about 50 feet back from the bulkhead, thus completing the tunnels.

The ends of the tunnels at the bulkhead will be blocked up temporarily, so that no large amount of water can come through the tunnel.

The Contractor will be allowed the use of as much of the bulkhead along the property above referred to and also of the bulkhead from 40th to 41st street, as can be given him without interfering with the work of other Contractors.

SPECIFICATIONS

Accompanied by Drawings for the

STRUCTURAL STEEL AND IRON WORK

of the new Waterside Power Station

To be erected on a property bounded on the north by 40th Street, on the south by 39th Street, on the east by the East River, and on the west by First Avenue, Borough of Manhattan, City of New York, being a part of contract signed September 15, 1904, between Post and McCord, Incorporated, Contractors, and The New York Edison Company.

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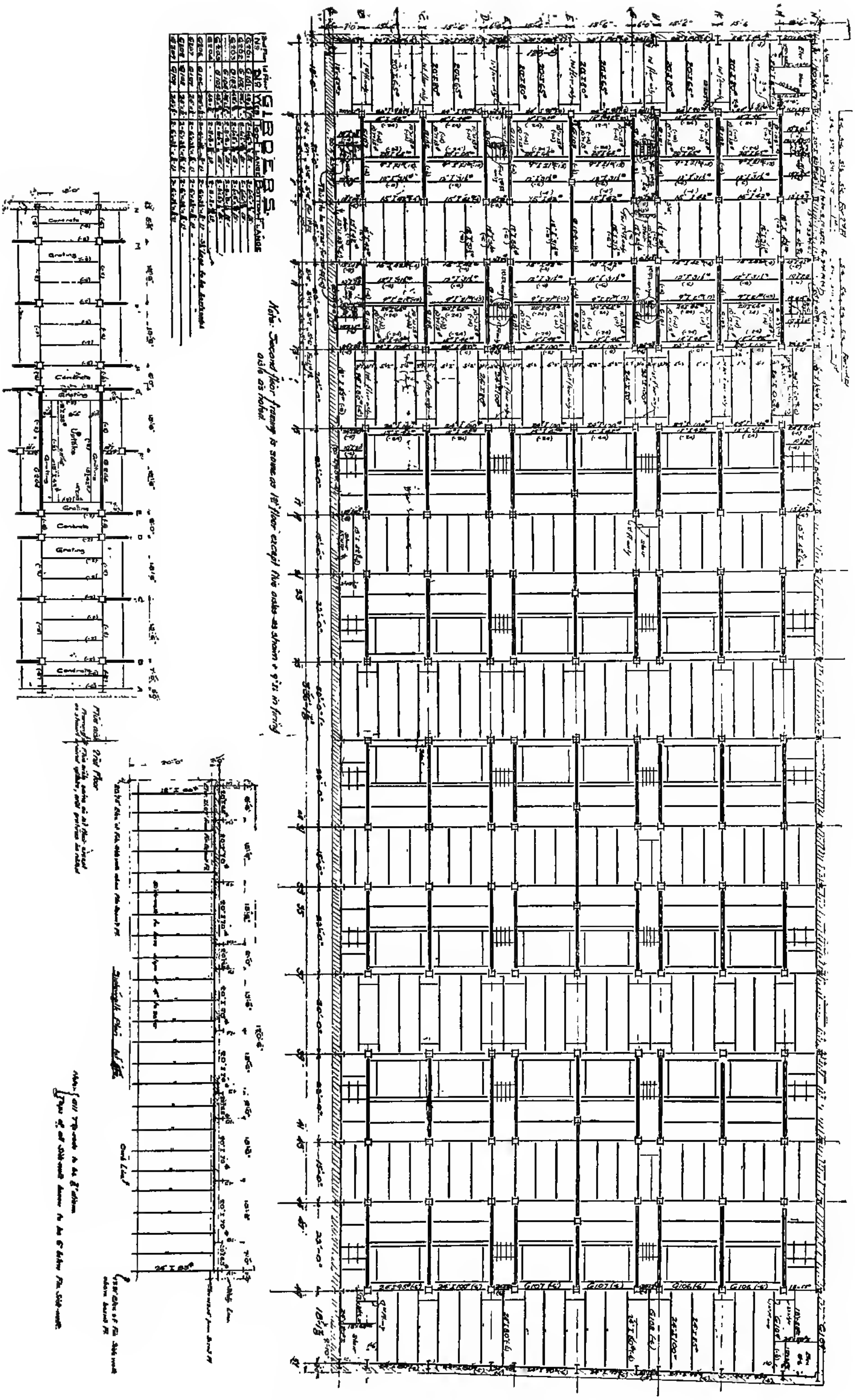
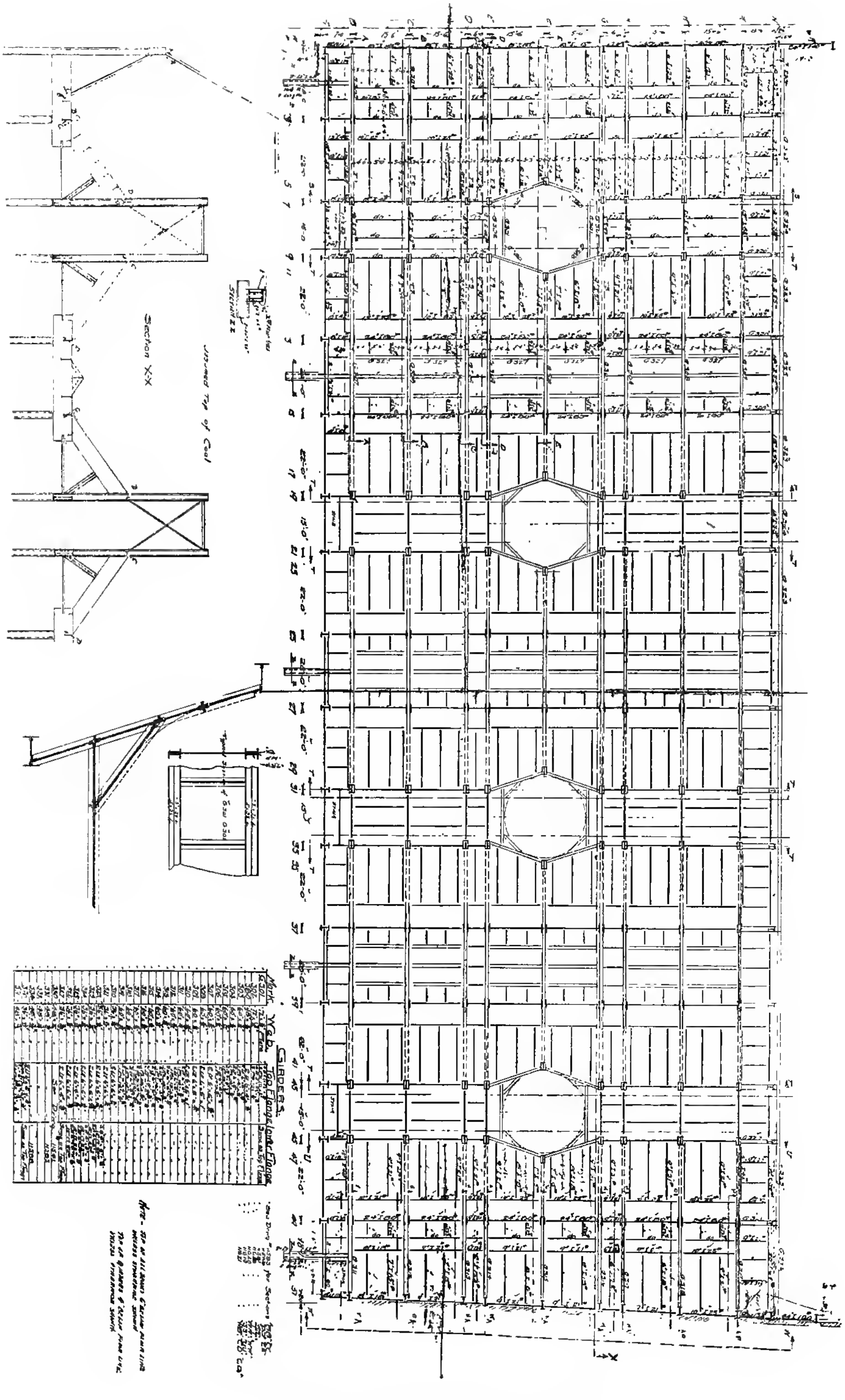
1. General Description of Work:

This contract is to include all the structural steel and iron work necessary for the installation of the complete power station, together with a complete ash pocket along the bulkhead, and two coal handling towers located one at each end of the ash pocket, connected with the power house by two horizontal bridges, together with the steel stacks, ash hoppers and downtakes, cast iron coal hoppers, flues and uptakes and boiler suspension rods, all as shown on the above tabulated drawings.

The necessary gratings for the walkways, flue aisles, etc., and the iron ladders leading to monitors, etc., are to be included in this contract, but the stair work and all miscellaneous ornamental iron work, such as grills, facias, etc., will be furnished under another contract. A general plan showing the locations of the operating room, boiler room, ash pocket and coal towers, is



STEEL PLAN, FIRST FLOOR.



STEEL PLAN, SECOND FLOOR.

shown on Drawing No. 11,162. The coal towers are to be continued up to a height about level with the boiler house roof and are to be connected together by plate girders. Lattice girders will be run from the east end of the boiler house monitors out to the above mentioned girders, connecting the coal towers together, so that the conveyors taking coal from the coal towers may deliver it into the cars running through the boiler house monitor.

All machinery, hoppers, etc., necessary for the coal and ash handling outfit will be furnished under another contract, but the Contractor is to furnish with the ash pocket the necessary gates and operating devices for delivering the ashes either into barges or into flat cars running underneath the ash pocket.

2. Classes into which Work is to be Divided:

The classes into which the work is to be divided for unit prices are as follows:

Class No 1—Steel Grillages:

Steel grillages are to be furnished for all building, ash pocket and coal tower columns in accordance with the sizes shown on Drawings Nos. 12,376 and 12,380. The tops of all grillages under building columns are to be 3″ below the finished basement floor.

Pipe separators are to be provided for the lower tier of the grillages and the ends of the upper tier. Under the columns, substantial angle and plate stiffeners are to be securely bolted to the upper tier of the grillage beams.

The price per pound given for this class is to be for the beams themselves, punched and coped in whatever way the nature of the work demands.

Cast iron separators are to be furnished for the grillage beams under the ash pocket and coal towers.

All separators, bolts, etc., that may be required for the grillages will come under another class, as hereinafter stated.

CLASS NO. 2—RIVETED STEEL COLUMNS:

The riveted steel columns for the building proper are to be built up in accordance with the material listed in the column schedule Drawing No. 11,617, and those for the ash pocket and coal towers in accordance with the material listed on Drawing No. 12,380. Base plates ¾″ thick shall be securely riveted to the bottom section of all columns and these base plates are to be bolted to the top of the grillages with ⅞″ bolts. Abutting surfaces of all columns shall be milled to a true surface at right angles to the axis. Stiffener angles must be milled and fitted to bear evenly under seat angles. The price per pound for this class is to include all base plates, brackets, stiffener angles, etc.

CLASS NO. 3—STEEL BEAMS AND CHANNELS 15 INCHES AND UNDER.

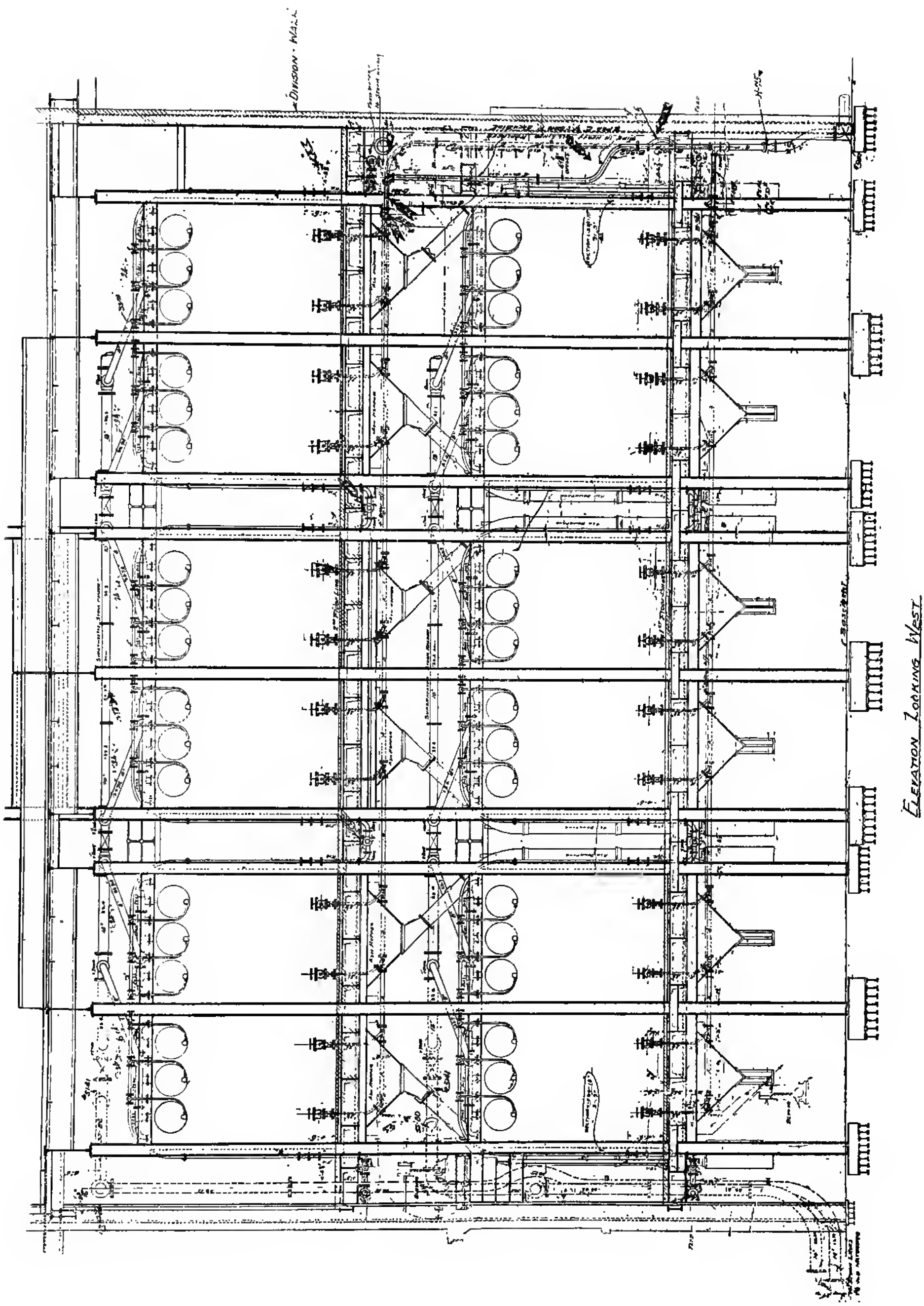
CLASS NO. 4—STEEL BEAMS OVER 15 INCH:

Under these two classes are to be included all the beams and channels required for the entire work as shown on the plans and set forth in the specifications, with the exception of those required for the grillages and all the beams and channels which form component parts of the materials called for in any of the other classes noted herein.

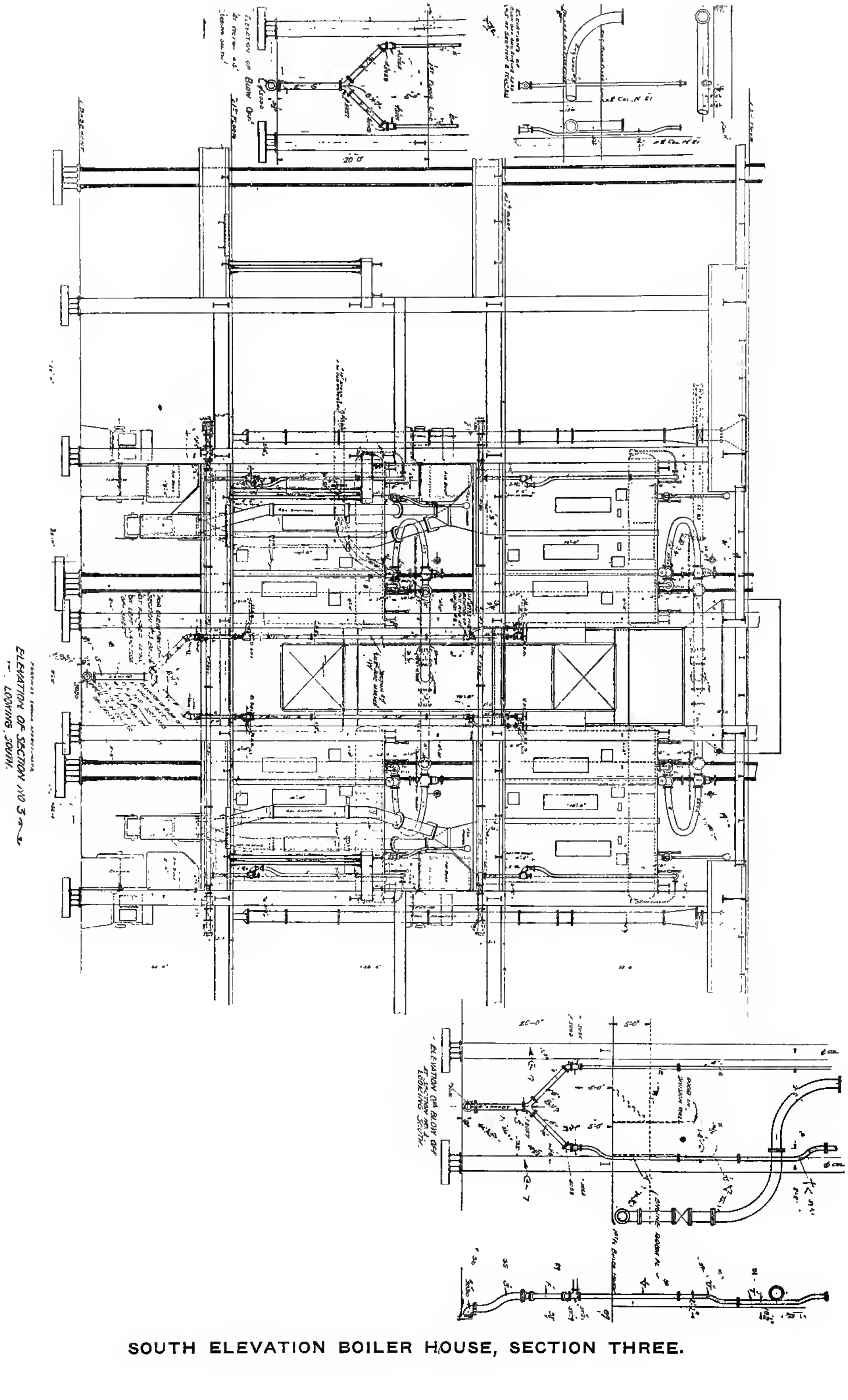
The prices for the above two classes are to be for the beams themselves, punched and coped in whatever way the nature of the work will demand. All brackets, shelf angles and tie rods that may be necessary for the above-mentioned beams will come under another class as hereinafter stated.

CLASS NO. 5—RIVETED PLATE GIRDERS:

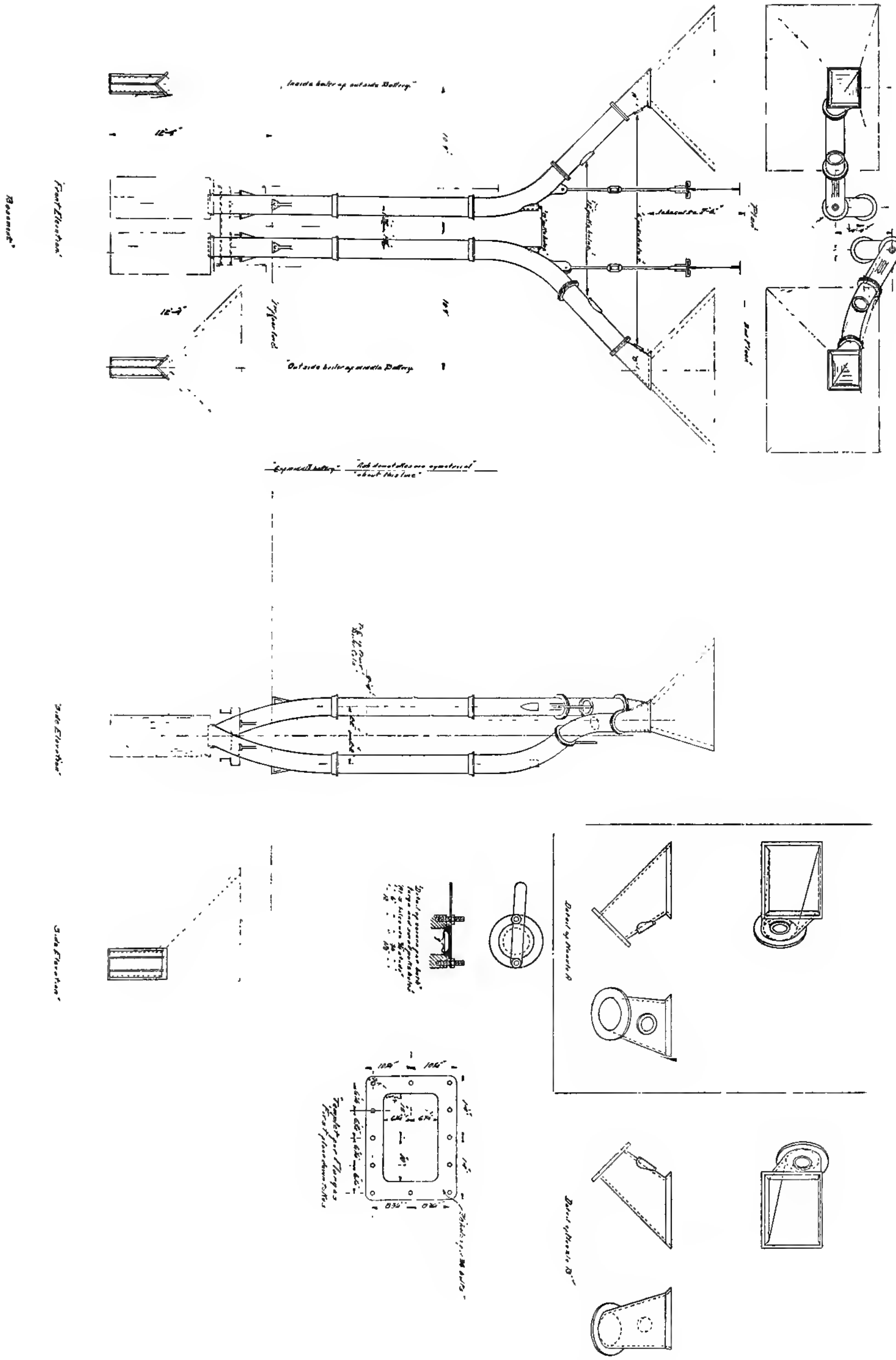
This class is to include all the plate girders required for the power station, ash pocket and coal towers; also all gutters formed by riveting a straight plate to the bottom of two channels. All stiffeners must be milled and fitted to bear evenly between flanges of girders. The price per pound is to be for the finished material, complete with all stiffeners, angles, fillers, rivets, etc.



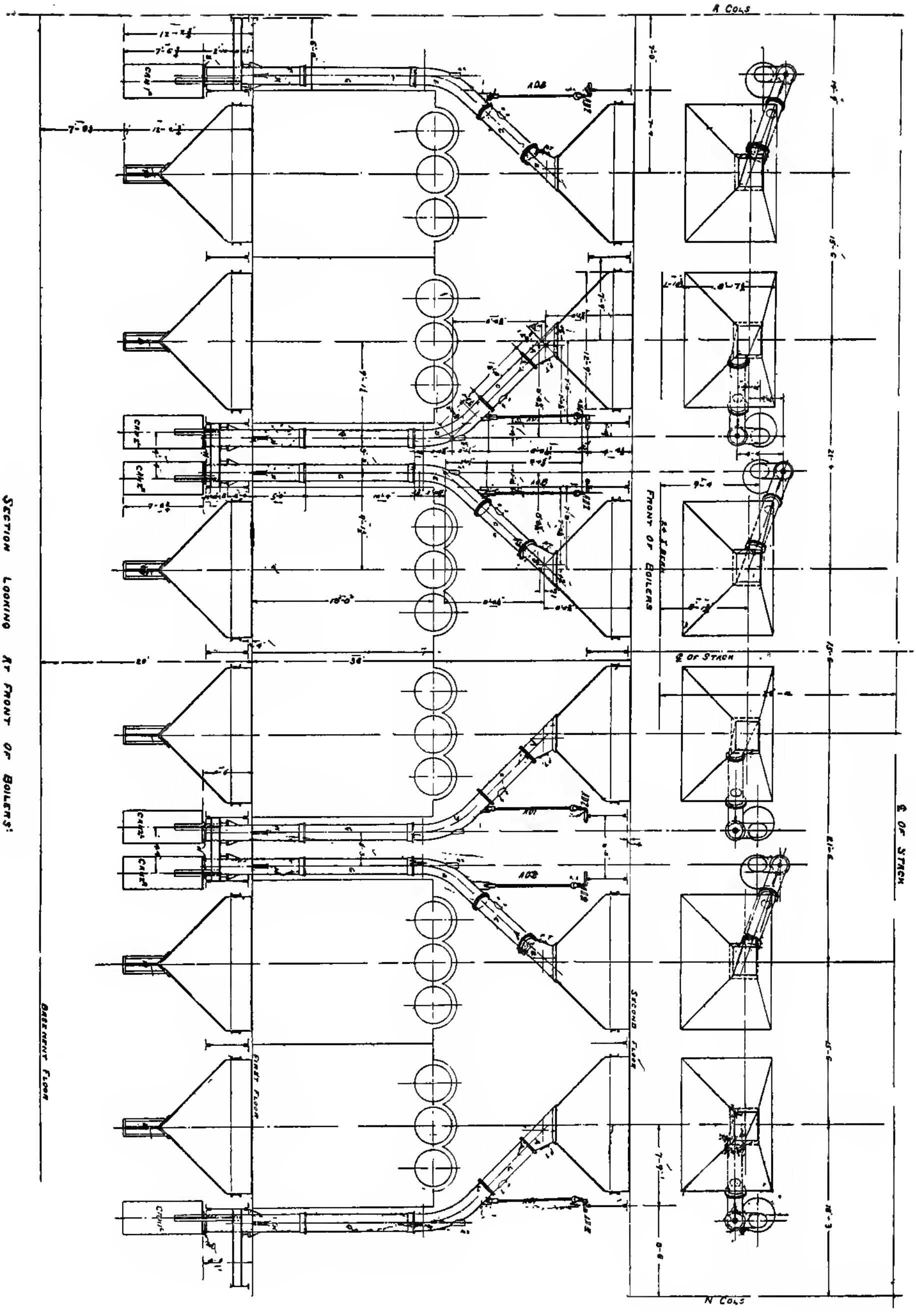
WEST ELEVATION BOILER HOUSE, SECTION THREE.



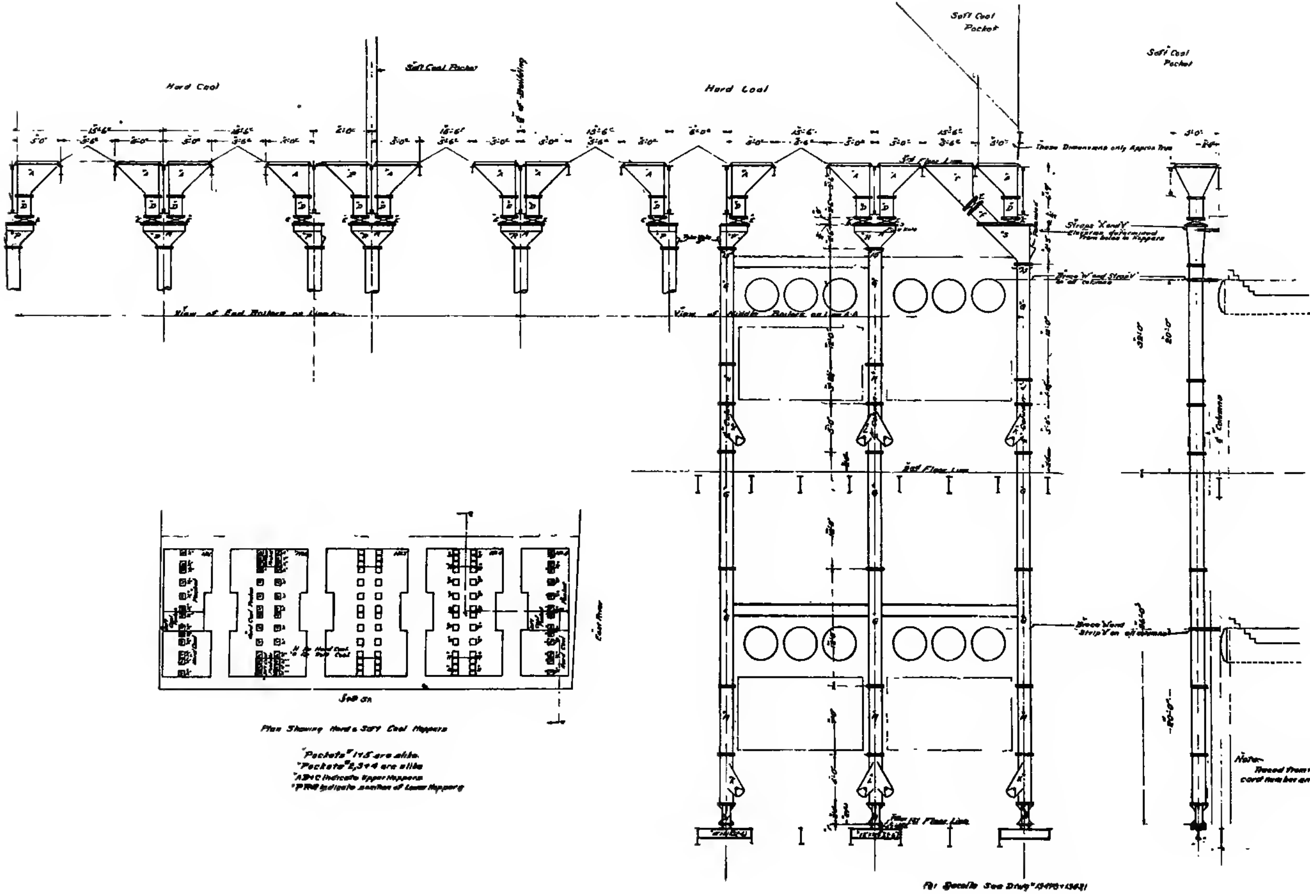
SOUTH ELEVATION BOILER HOUSE, SECTION THREE.



ASH DOWNTAKES, DETAILS.



ASH DOWNTAKES, ELEVATION.



[illegible]	Piece	[illegible]
A	Upper Hopper	96
B	Upper Hopper	2
C	Upper Hopper	12
D	Upper Hopper Pipe	58
E	Upper Gate Valve	110
F	Upper Hopper Pipe	12
G	Downtake Pipe	216
H	Downtake Pipe	60
J	Downtake Pipe	12
K	Outlet Valve	96
L	Outlet Valve	48
M	Downtake Pipe	72
N	Pipe Column	72
P	Lower Hopper	34
R	Lower Hopper	26
S	Lower Hopper	12
X	Support for P&S	46
Y	Support for PR&S	95
Z	Cover for N	72
V	Clamp	144
W	Bracket	144

SOFT COAL HOPPERS.

Class No. 6—Roof Trusses, Latticed Girders, Ventilator Frames and Trusses for Bridges Between Coal Towers and Boiler Room:

The price per pound for this class is to include all gusset plates, fittings, etc., which form component parts of the above pieces.

Class No. 7—Clips, Tie Rods and Anchors:

All clips that are attached to any of the material listed in classes 3 and 4, and all separators, bolts, etc., that may be required for the grillages, together with all clips that may be shipped loose, are to be included in this class; also all tie rods and anchors that may be required for any part of the work.

Class No. 8—Steel Stacks:

Four (4) steel stacks will be required, 232 feet high and 22 feet 6 inches (22′ 6″) outside diameter. The price per pound for these stacks is to include vertical angle iron stiffeners, the angular rings for supporting the brick lining, the bonnet and plate curbing where the stack runs through the roof, the walkway and railing around top of the stack, together with a ladder running the entire length of the stack, all as shown on Drawing No. 12,377, including also the cast iron cap.

The stacks are to be riveted throughout, ¾″ or ⅞″ rivets being used. The horizontal seams for the first 113 feet in height are to be double riveted and all other seams may be single riveted.

The base of the stack is to be securely bolted to the third floor framing of the boiler room with ⅞″ bolts.

Class No. 9—Flues and Uptakes:

The general layout of the flues and uptakes for twenty-four (24) boilers is shown on Drawing No. 12,713. Four such systems will be required, together with the cast iron dampers as shown on Drawing No. 12,714. The damper shafts and bearings

for same are to be furnished and erected under this contract, but no damper operating mechanisms are to be included.

The flues are to be bolted together, ⅞″ bolts being used where possible, and in no case shall any bolt smaller than ¾″ be used.

Class No. 10—Wind Bracing, Miscellaneous Angle Iron Framing and Tees:

This class is to include all the wind bracing, miscellaneous angle iron framing and tees that may be necessary for any part of the work.

Class No. 11—Steel Plate Gutter Linings:

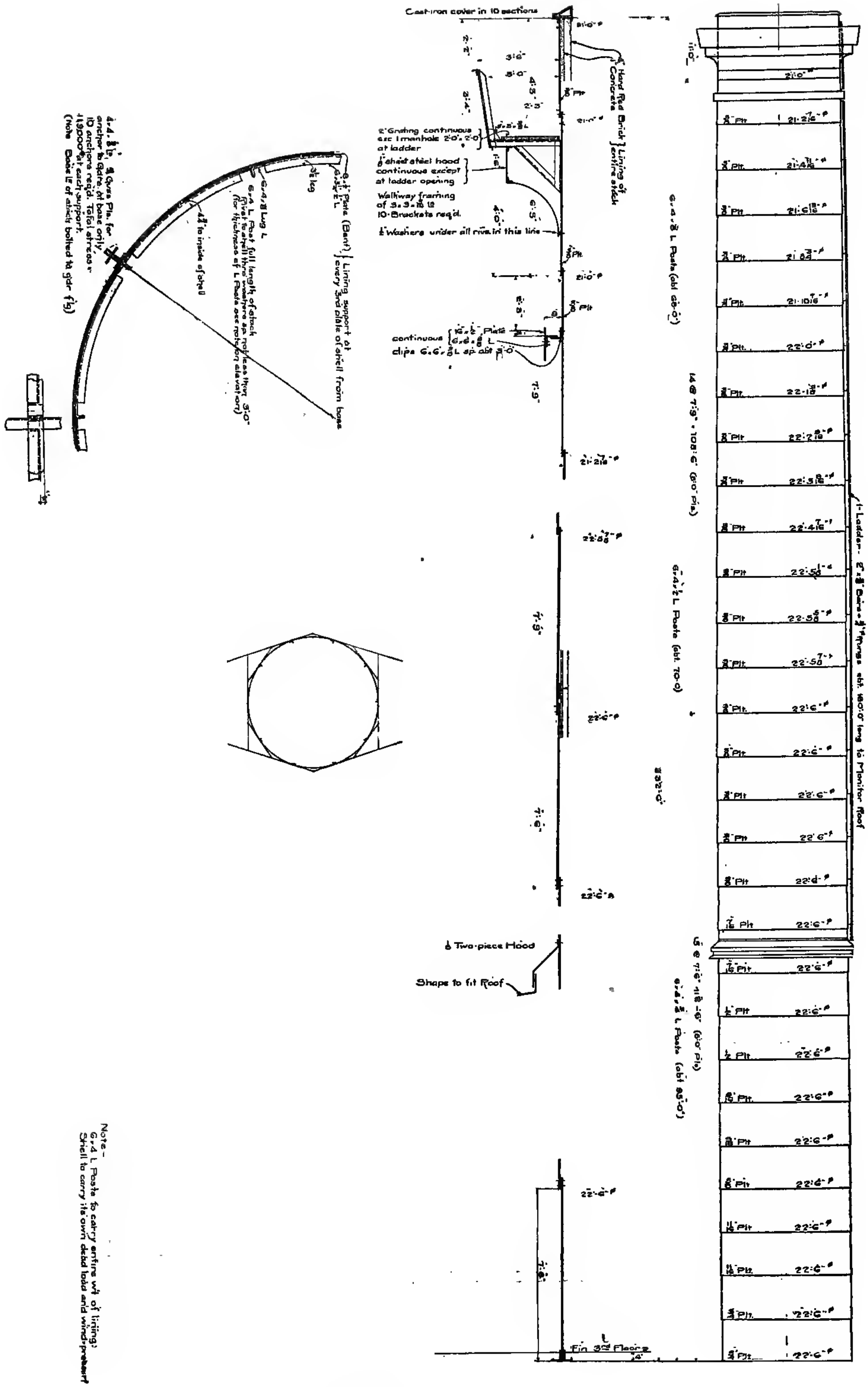
The steel plate gutter linings are shown on Drawing No. 12,383.

Class No. 12—Ladders and Gratings:

Gratings will be required for the second and third floor boiler room as shown on drawing, and in both the engine and boiler room monitors, together with ladders leading up to same. Miscellaneous gratings for the same purpose may be required in other parts of the building.

Class No. 13—Boiler Hangers:

On drawings Nos. 9,995 and 12,159, details of the suspension "U" rods for hanging the boiler drums are shown. The price given for these rods is to include nuts and washers. The rods are to be 1½ inch diameter, upsetting to 2 inches, and these upsets must be made in an upsetting machine; no welding will be allowed. These rods are to be delivered at the station and will be erected by another contractor.



Cast-iron cover in 10 sections
Hand Red Brick Lining of entire stack
Concrete
sheet steel hood continuous except at ladder opening
10-Brackets req'd.
Washers under all rivs in this line
continuous
Two-piece Hood
Shape to fit Roof
Fin 3rd Floors
Lining support at every 3rd plate of shell from base
to inside of shell
Note-
6×4 L Posts to carry entire wt of lining;
Shell to carry its own dead load and wind pressure

STACKS.

CLASS NO. 14—CAST IRON WORK FOR ASH HOPPERS:

The cast iron work for the ash hoppers is to include the ash downtakes, soot pipes, and all castings shown on the detail drawings.

The cast iron dampers and shafts for same are to be included, but no operating devices are to be furnished for the dampers. The gates at the bottom of the ash downtakes below the first floor are not to be included.

CLASS NO. 15—STEEL PLATE AND ANGLE IRON WORK FOR ASH HOPPERS:

The general layout of the ash hoppers, downtakes and soot pipes is shown on Drawings Nos. 10,952 and 12,378. The ash hoppers are to be bolted together.

CLASS NO. 16—CAST IRON COAL HOPPERS:

The coal hoppers are shown in detail on Drawing No. 10,813.

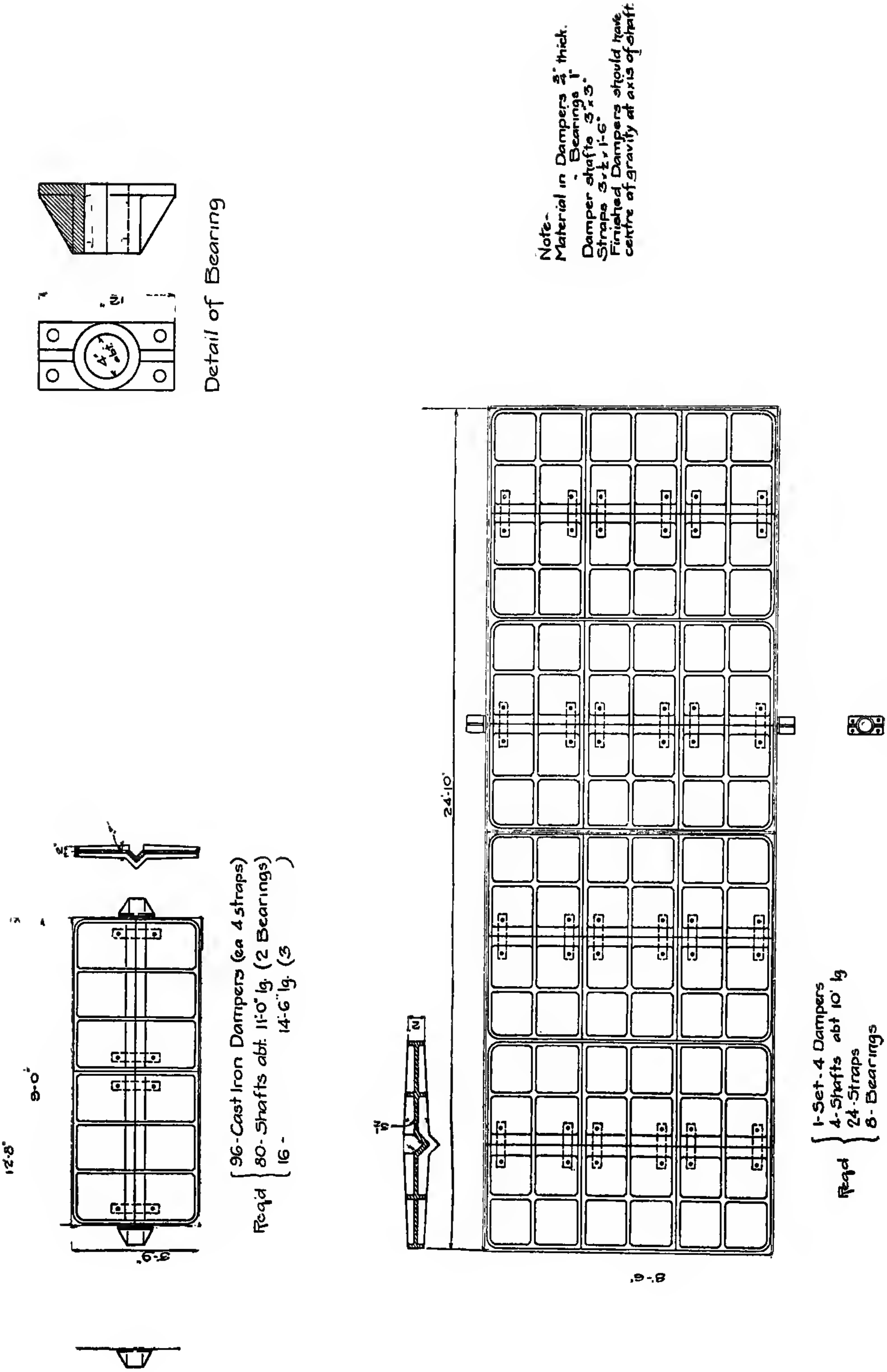
3. CONNECTIONS TO BE BOLTED OR RIVETED:

The columns are to be bolted to the grillages and all floor beams framing into girders or floor beams are to be bolted, except that all connections for beams forming a part of the coal pocket construction are to be riveted. Roof purlins and tees are to be bolted. All other connections are to be riveted.

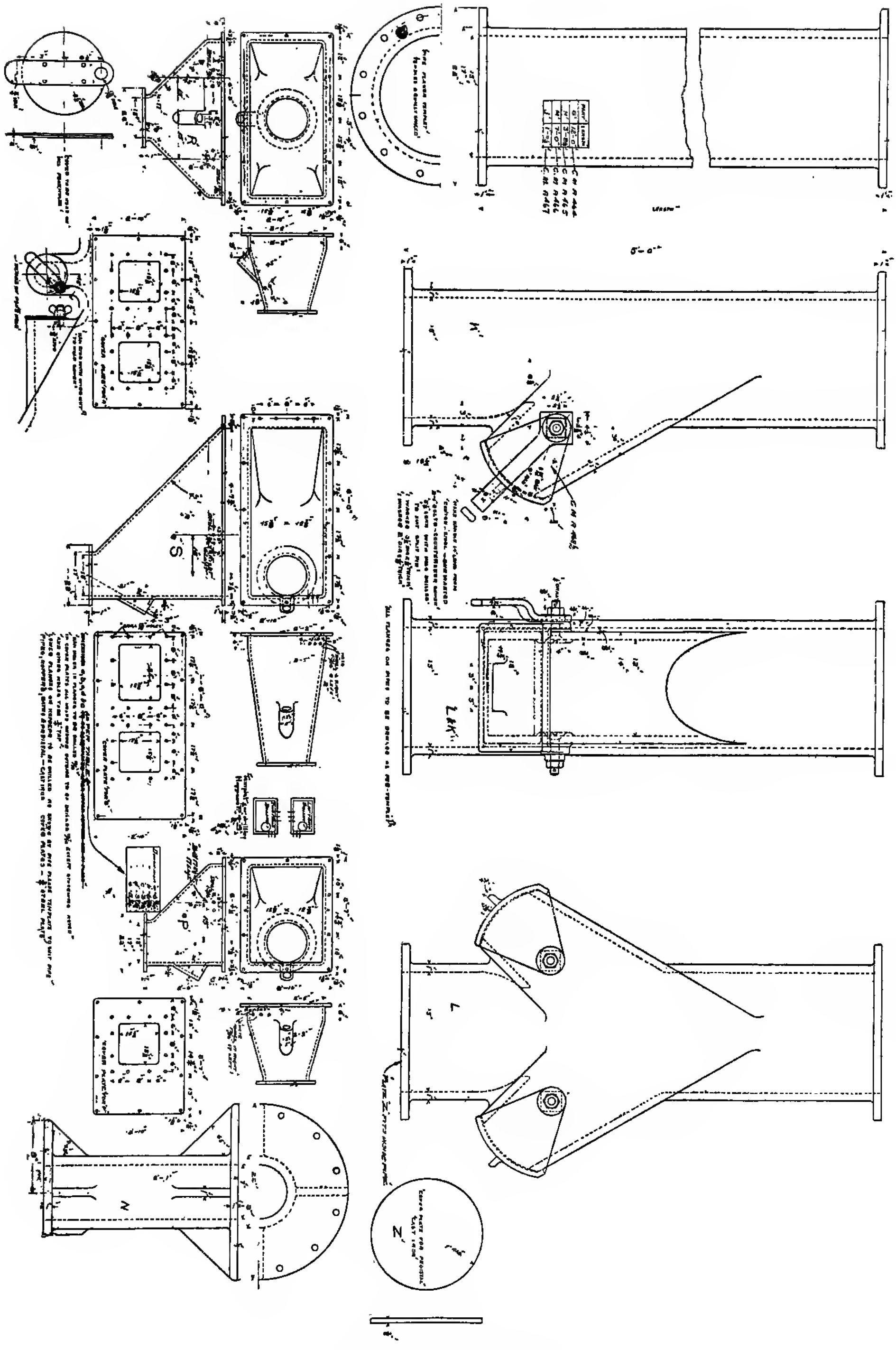
4. PAINTING:

All steel and iron must be cleaned of mill scale, dirt, oil or rust before leaving the shop; it is then to receive one coat of Sherwin-Williams Metalastic Black Paint taken from the orignal package without admixture of dryer or other thinning material.

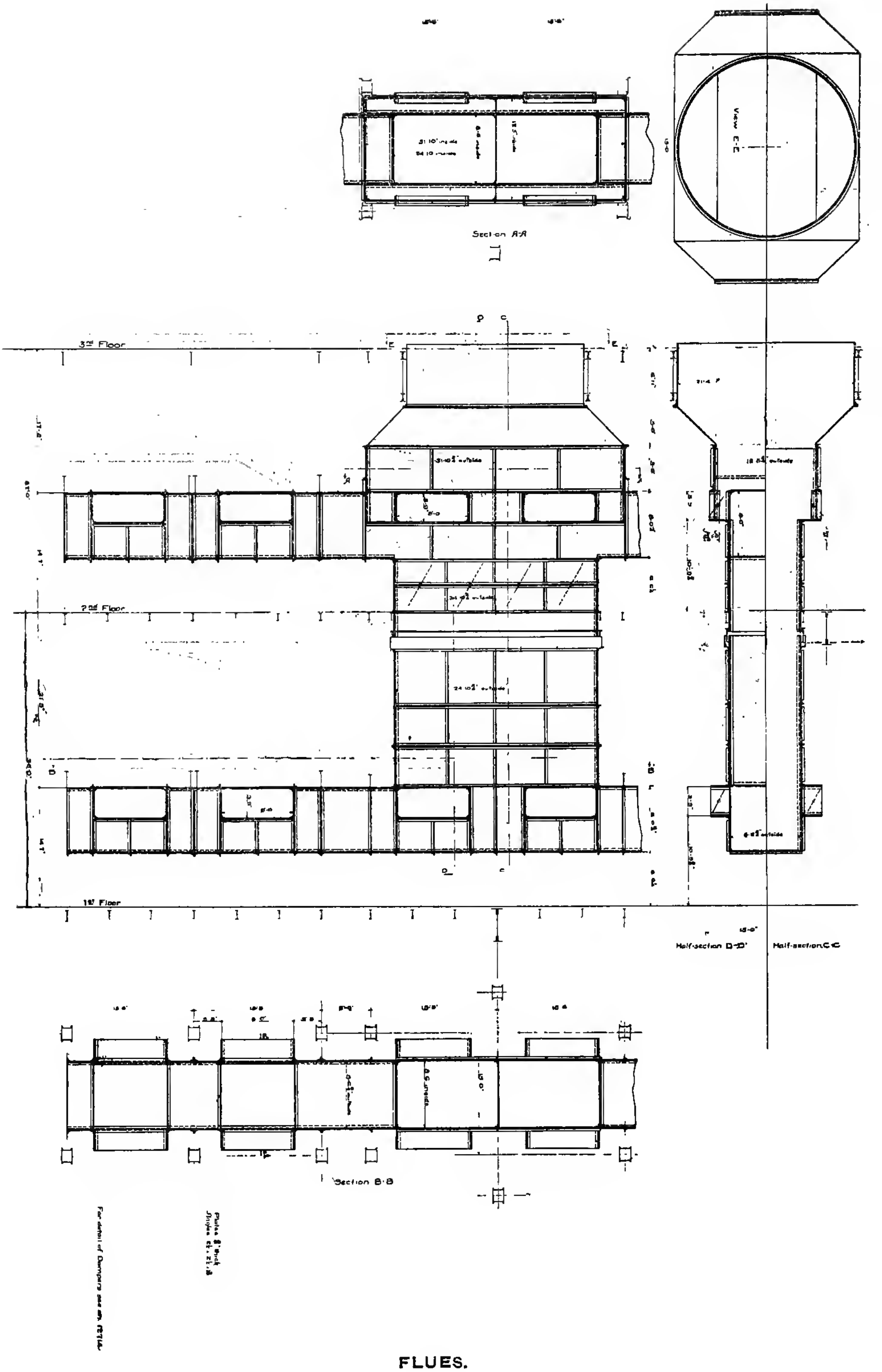
In the case of all riveted work, the surfaces coming in contact, the bottom surfaces of bed plates, bearing plates and all parts not accessible for painting after erection shall be painted



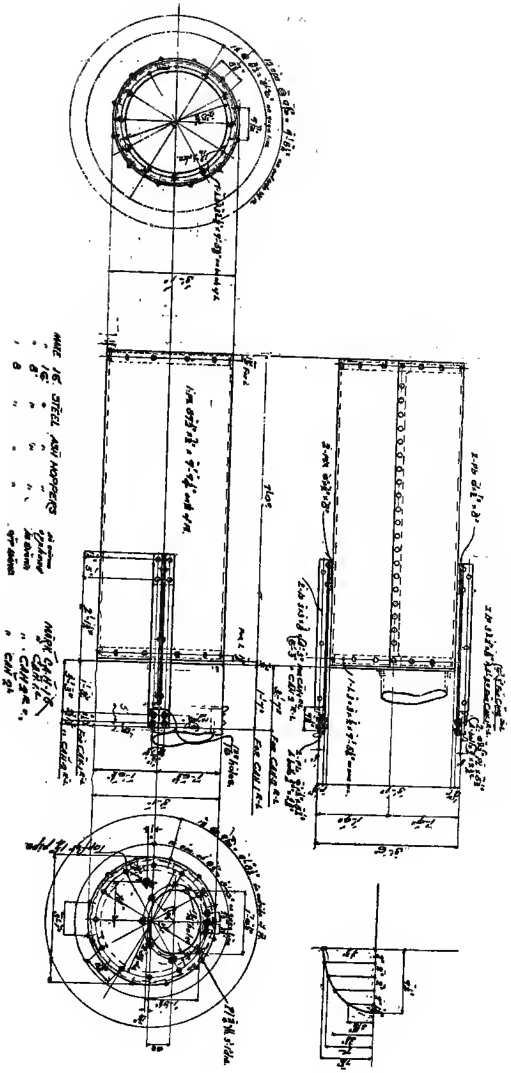
FLUE DAMPERS.



COAL DOWNTAKES, DETAIL.


Section A-A
View E-E
3rd Floor
2nd Floor
1st Floor
Half-section D-D'
Half-section C-C
Section B-B
For detail of Dampers see

FLUES.



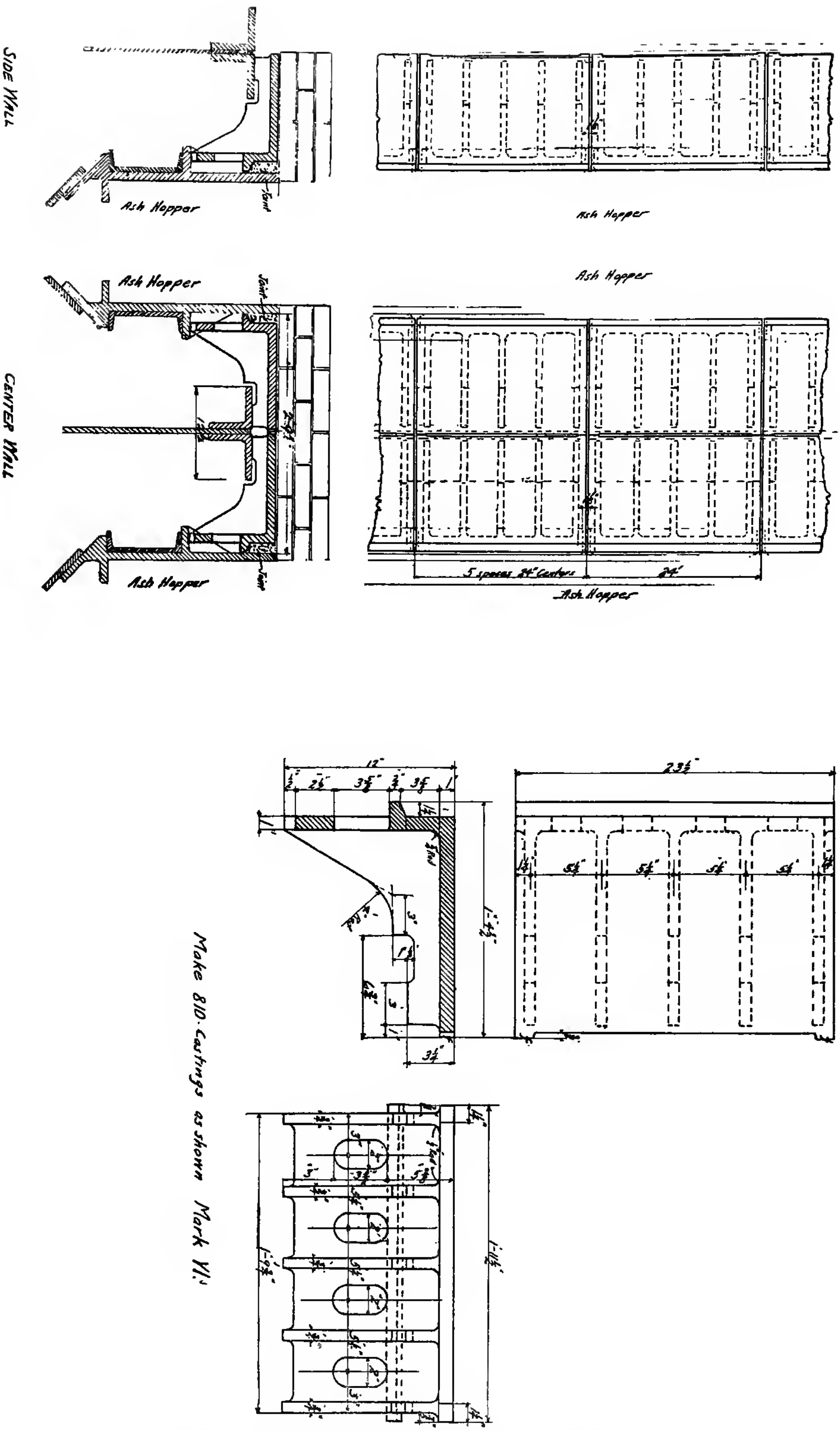
SHOP BILL

18 ORDER No. 8800 I

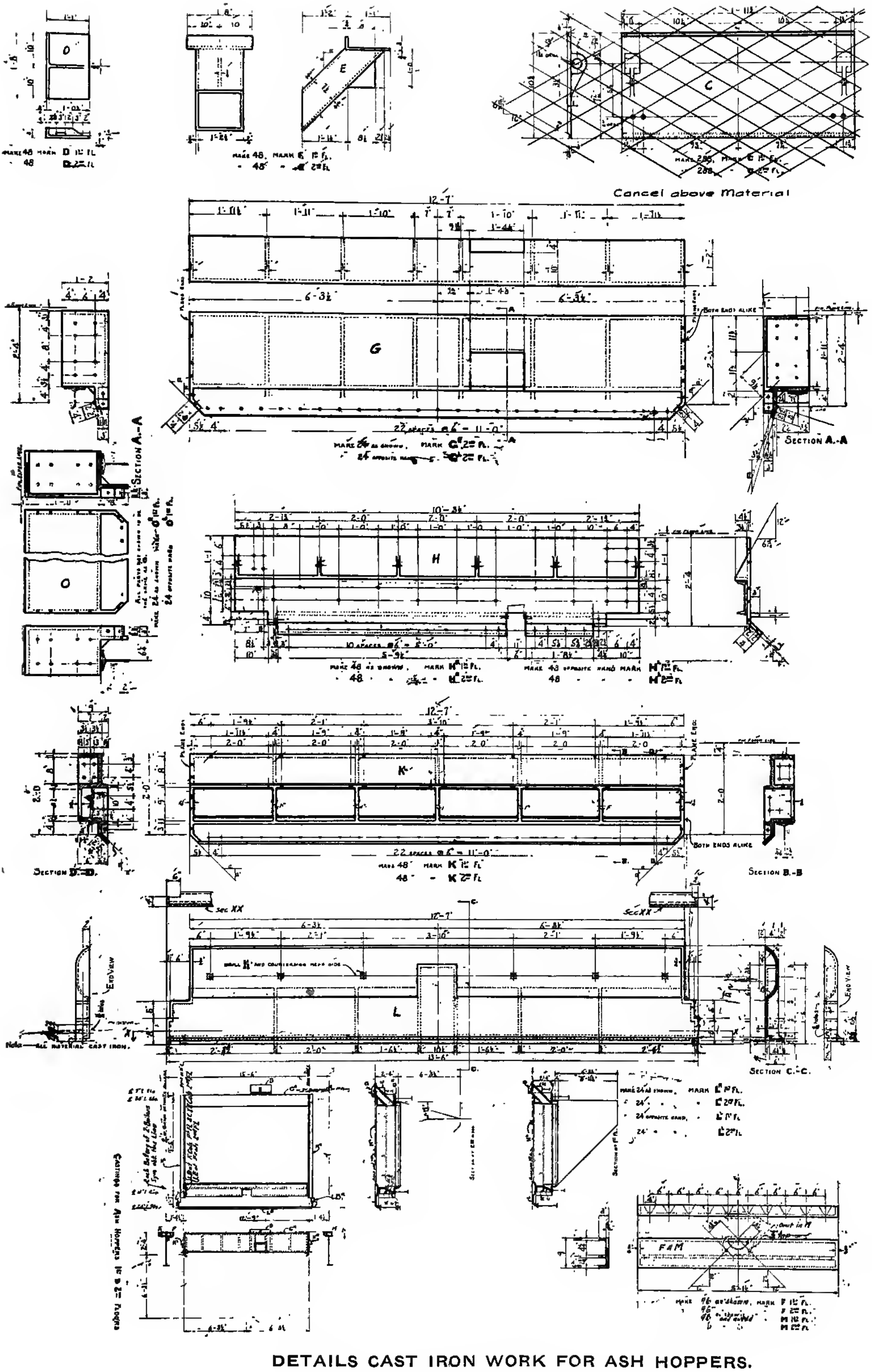
Brooklyn PLANT — Brooklyn PLANT

	48- Hoppers-CAH.1-8				
48	Pl. 89½ x ½	9'	9½"		17
48	circular Pl ⅜" th.	3'	7" dia.		18
64	L 3 x 3 x ⅜	6	3	For CAH	
128	L 3 x 3 x ⅜	4'	3"	For CAH	
96	L 3 x 3 x ½	9'	5⅞"		20
					19
192	Pl. 6 x ½	0'	8"		21
192	" 6 x ½	0	5½		21
384	⅝" bolts	0	2½		

ASH DOWNTAKES, DETAIL.



DETAILS CAST IRON WORK FOR ASH HOPPERS.



DETAILS CAST IRON WORK FOR ASH HOPPERS.

with two coats of Sherwin-Williams Metalastic Black Paint as before.

After the structure is erected, all mud and dirt is to be removed and all abrasions in the first coat of paint must be brushed with a stiff wire brush and then touched up. The structure is then to be thoroughly and evenly painted with one additional coat of Sherwin-Williams Metalastic Brown Paint taken from the original package without admixture of dryer, oil or other material.

Paint is to be carefully, evenly and thoroughly applied so as to cover the entire surface and be well worked into all interstices. No painting (except under cover) shall be done in wet or freezing weather, and not until the preceding coat is thoroughly dry.

The Sherwin-Williams Metalastic Paint shall be of standard composition, equal to the sample submitted. The oil used in the paint shall be pure linseed oil properly mixed with dryer. The pigment shall be ground in oil as fine as samples submitted. The paint shall be sampled from time to time by the Company's inspector.

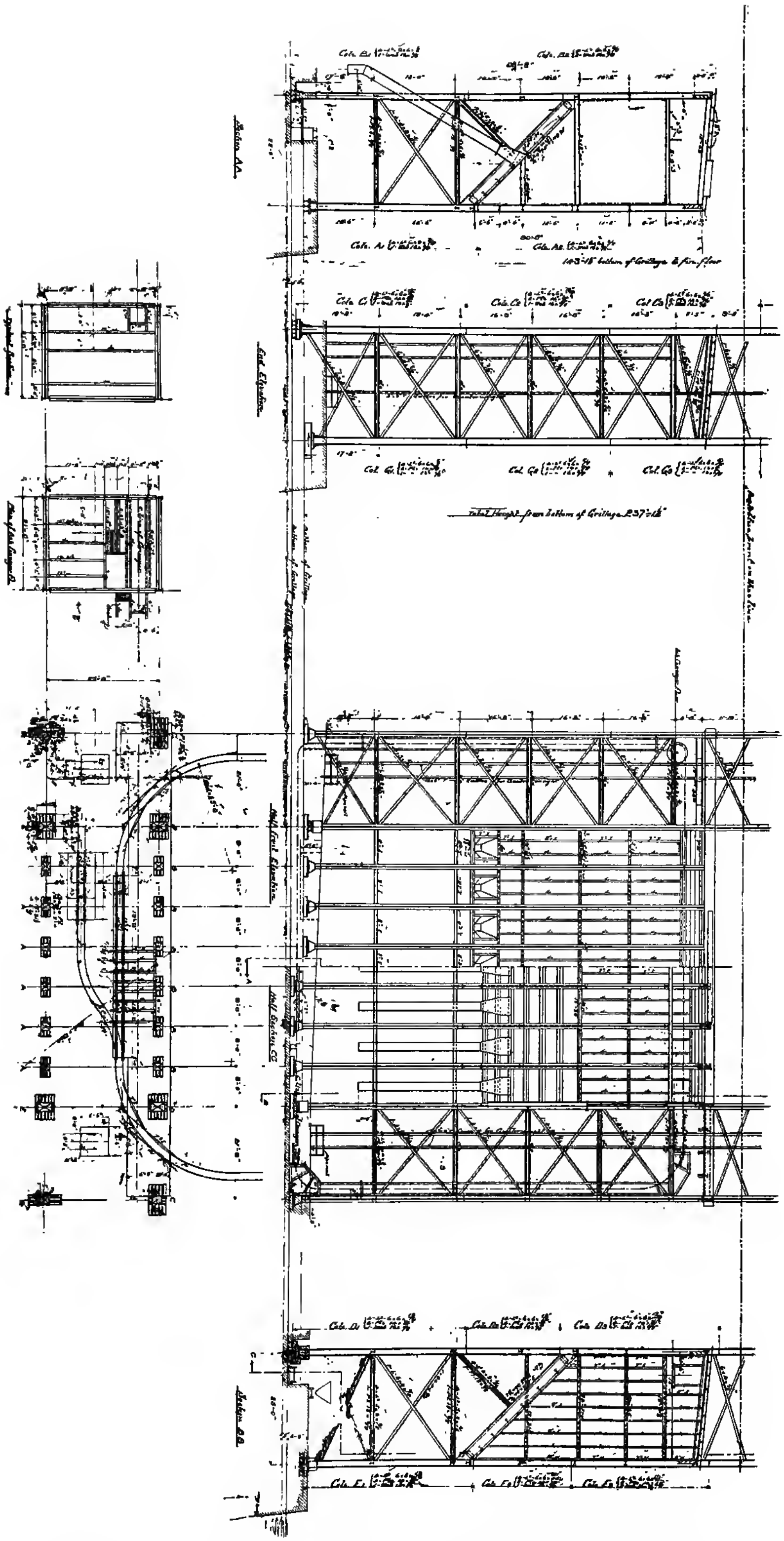
Cast iron shall be shipped to the ground unpainted, properly cleaned of rust and painted two coats of Sherwin-Williams Metalastic Paint of different colors after being erected.

5. Drawings to be Furnished by Contractors:

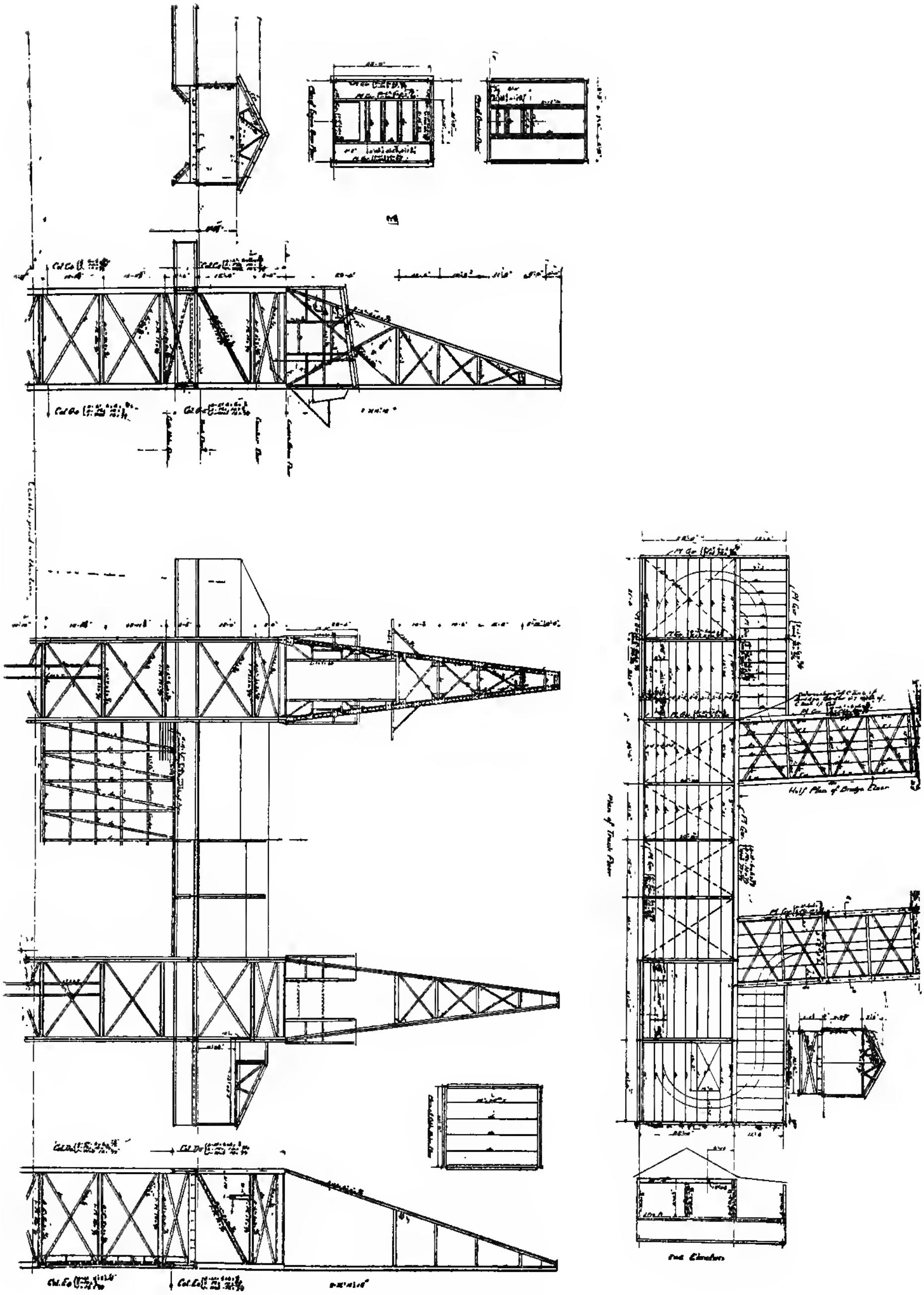
The Contractor is to submit to the Engineer full detail and shop drawings for approval, before commencing work, and three sets of approved drawings are to be furnished to the Company for their use. In addition, two sets of blue prints on cloth of the general plans are to be furnished for filing with the Building Department.

6. Times of Completion:

The grillages for the column foundations of the power station proper are to be delivered on or before March 1, 1905. The basement columns are to be delivered on or before May 18,



ELEVATION COAL TOWER AND ASH POCKET (LOWER HALF).



ELEVATION COAL TOWER AND ASH POCKET (UPPER HALF).

1905, and the one third nearest the East River is to be completed so that the installation of the boilers on the first floor may be begun by July 1, 1905.

The entire station proper is to be completed by January 1, 1906. The ash pocket and coal towers are to be completed within six months after the foundations are ready.

These dates are conditioned upon the foundations for the eastern one-third of the building being ready for the grillages on or before March 1, 1905.

7. Provision for Unloading Material:

The Contractor will be allowed the use of the 39th street pier, if completed in time, and such portions of the bulkhead as may be necessary to unload the steel from lighters, but he must so regulate his use of the bulkhead as not to interfere with the work of other contractors.

SPECIFICATIONS

Accompanied by Drawings for the

SUPERSTRUCTURE

of the new Waterside Power Station

To be erected on a property locnted on First Avenue and [the East River and 39th and 40th Streets, Borough of Manhattan, City of New York, being a part of contract signed July 18, 1905, between the Murphy Construction Company, Contractors, and The New York Edison Company.

1, Description of the Building:

The power station is to be erected on a property at First Avenue, 39th and 40th Streets, and the East River, commencing at a point at the intersection of First Avenue and 39th Street, running thence northerly 197′ 6″, thence easterly 347′ 2″, thence southerly 197′ 9¾″, thence westerly 336′ 1⅞″, to the point of place of beginning.

The work to be executed under this contract includes the erection of the superstructure and all work above a point 2″ below the basement floor level, and all of the foundation work below this point is not to be provided.

The entire basement wall on 39th Street from the level of the basement floor up to the sidewalk level is not to be included in this contract.

2. Concrete Walls and Turbine Foundations:

The walls of the vaults under the First Avenue and 40th Street sidewalks, also all turbine foundations, shall be constructed of concrete.

Provide the steps and platform in basement entrance area on 40th Street, near First Avenue, of concrete; steps and platform to be formed so as to allow for an additional coating of at least 2″ of a hard granolithic material which is hereinafter specified. Provide a cinder concrete filling under the concrete steps and platform which shall be no less than 12″ thick. Platform to be pitched to the drain in center.

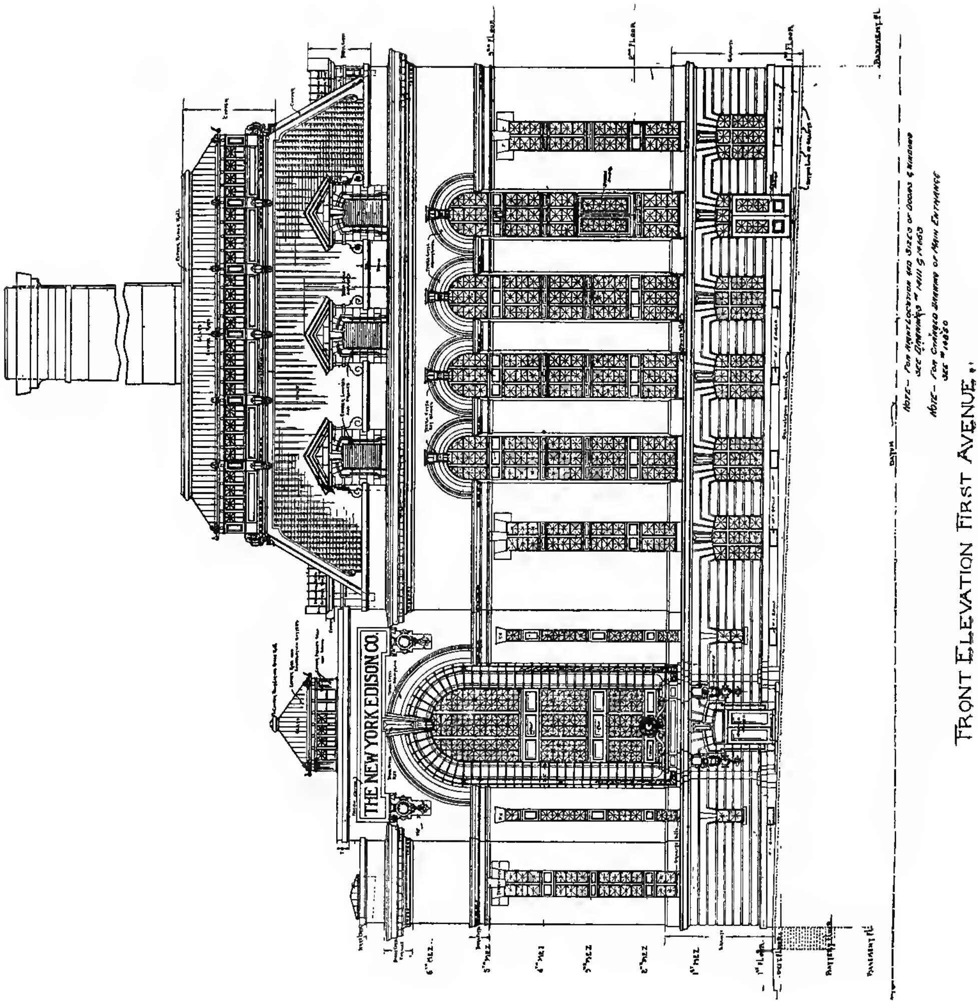
All grillage beams projecting above the basement floor shall be encased with concrete and finished with a coat of granolithic material.

The concrete shall be composed by measure of one part of cement, three parts of clean sharp sand and five parts of broken bluestone chips or gravel.

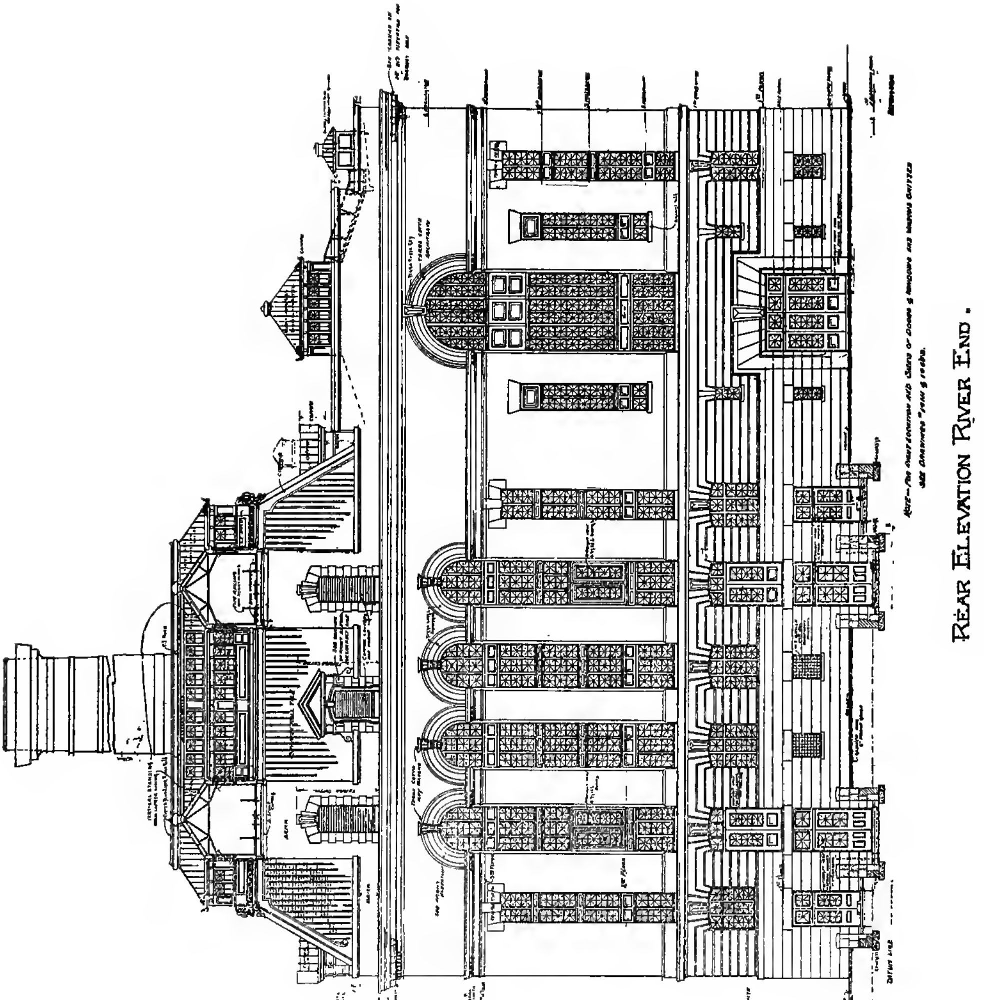
The cement shall be of the very best Portland cement of American make that will be satisfactory to the Company.

The cement shall conform with the requirements hereinafter outlined under "Mortar."

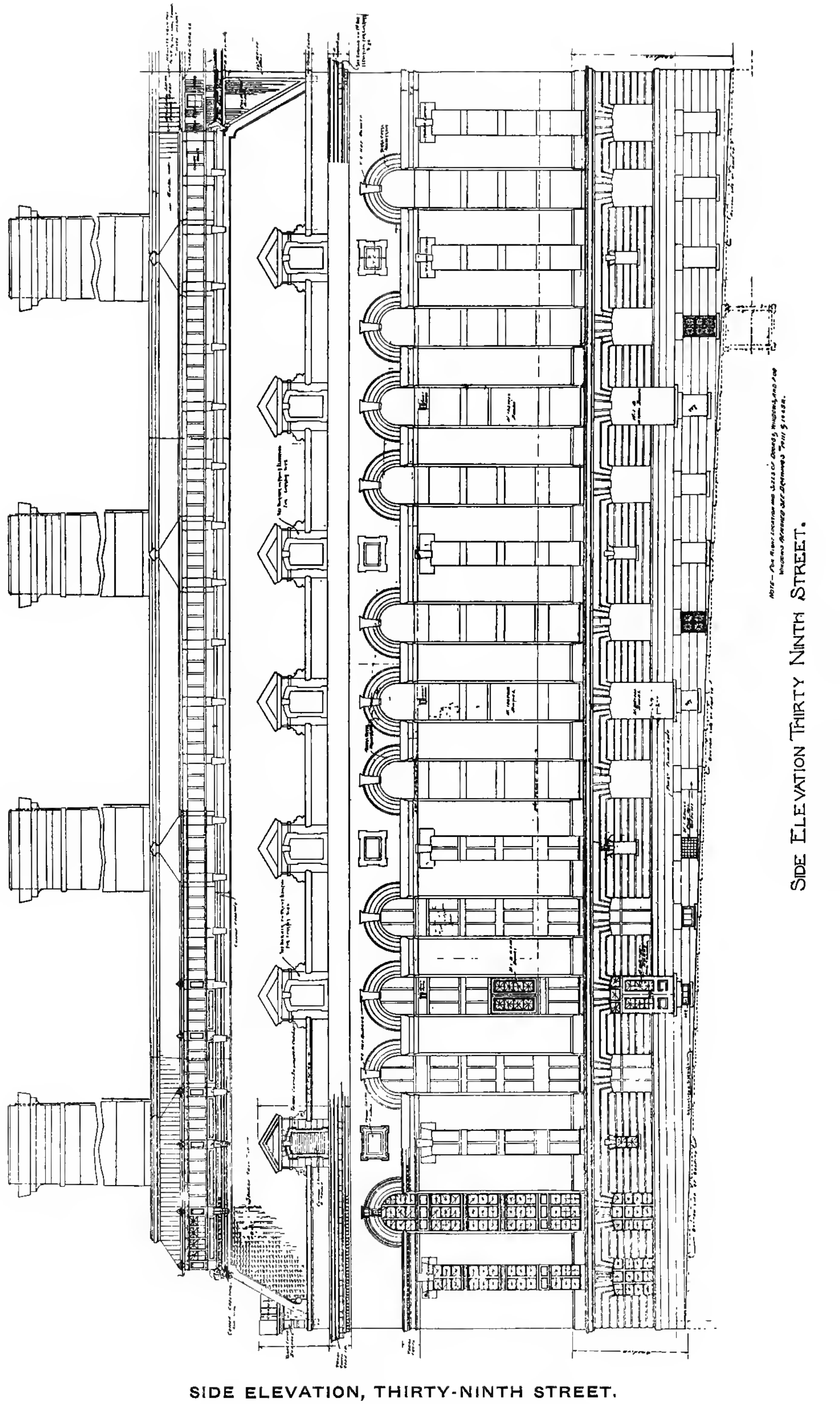
The cement and sand shall be thoroughly mixed dry, the proper quantity of clean water shall then be mixed in, and the clean, moistened stone shall then be added to the mass and the whole thoroughly mixed. The amount of water added shall be such as to assure a monolithic mass of concrete. All concrete shall be thoroughly rammed in place before the cement has begun to set. The mixing of the concrete shall be done by a mixing machine whenever possible, or as directed by the Company. The broken stone shall be wetted down and then thoroughly mixed with the mortar, and all material shall be measured in bulk. Whenever a mixing machine is not used, the concrete is to be mixed on plank platforms in small and convenient quantities and immediately deposited in the work. It



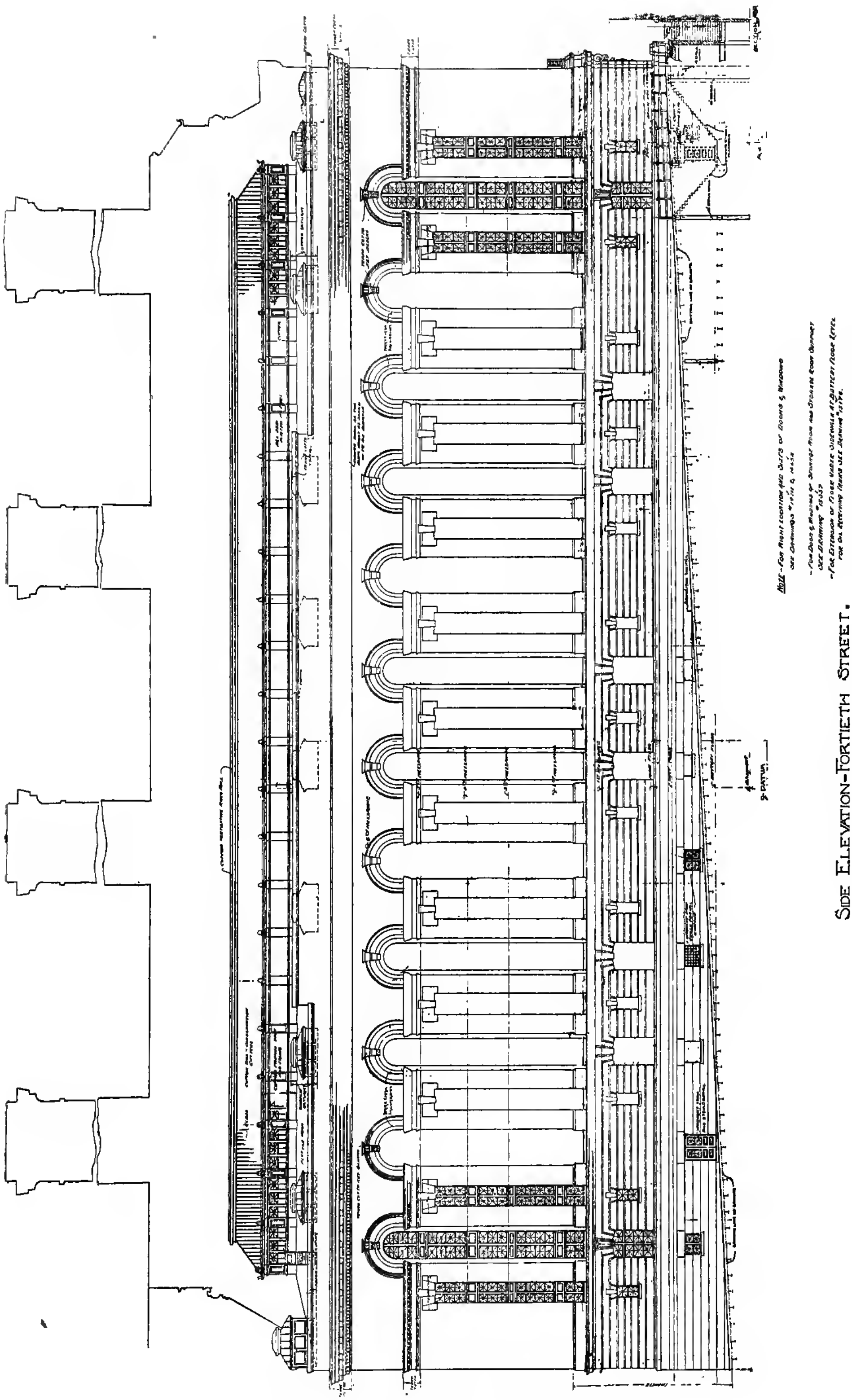
FRONT ELEVATION, FIRST AVENUE.



REAR ELEVATION, EAST RIVER.



SIDE ELEVATION, THIRTY-NINTH STREET.



SIDE ELEVATION, FORTIETH STREET.

shall be laid in sections and in horizontal layers not exceeding nine inches in thickness and it must all be thoroughly rammed. In no case is any concrete to remain in the work if it has begun to set before the ramming of same is completed. Plank and timber curbs must be furnished by the Contractor to confine the concrete in the shape and dimensions called for by the drawings. Curbs are to be dressed on one side. Before any weight is placed on the concrete, it must have as much time to set as can be conveniently allowed, and in no case less than 24 hours. In cold weather, the concrete is to be heated as directed by the Engineer. All water used in making concrete and mortars must be fresh and clean; salt water is not to be employed.

The foundation work is to include the erection of foundation bolts and anchor plates which are to be distributed in the mason work as per detailed drawings to be afterwards supplied. The foundation bolts and plates are to be set in place by the Contractor, but the bolts and plates are to be supplied by the Company in addition to any other iron or steel that may be necessary for the foundation construction. The turbine foundations are to be of about the dimensions shown by the drawings, but the exact proportions are to be given by detailed drawings, which will be supplied at a later date.

The Contractor shall furnish and set the ¾" x ¾" square steel bars in the concrete vault walls under the First Avenue and the 40th Street sidewalk. The re-enforcing bars shall be the entire height of the walls, and shall be placed 6" on centers.

The Contractor shall furnish and erect a complete wooden form (or mould) for each foundation and also a complete template for locating the foundation bolts. All of the exposed surfaces of the concrete foundation work and walls shall be finished smooth.

The Contractor shall provide the cinder concrete filling for all roof gutters graded to leader outlets.

The Contractor shall furnish the exact amount of concrete work required for the walls and piers, and he is also to furnish the number of cubic yards of concrete for the turbine foundations specified on the plans. In case the amount of concrete

actually furnished is more than, or less than, the amounts to be so furnished, the Contractor is to charge or credit the Company at a unit rate price per cubic yard, which shall be stated in proposal.

3. Brickwork:

All walls, piers, etc., beginning at a point from the top of the concrete foundations (or basement floor level) up to and above the roof, shall be built of the best hard burned brick, to be selected by the Company. Brick shall be bonded and bedded with all joints and crevices slushed full of mortar, every sixth course throughout to be a heading course. All walls, piers, etc., are to be built perfectly plumb and true in straight, level courses according to the dimensions and requirements shown on the drawings.

All joints shall be made as nearly as possible of uniform thickness, not to exceed ⅜ of an inch. All brick used on exposed surfaces are to be culled and of uniform size, and such brick shall have smooth surfaces and straight arises. The brick shall be clean and thoroughly wet just before being laid, except in freezing weather, when they are to be kept dry.

Broken brick must not be brought to the ground, and such as are broken afterwards in handling shall be used only in making closures, or as otherwise directed.

Additional Brickwork.

Should the further development of the plans require an additional amount of common brick than the amount indicated by the drawings, the Contractor is to furnish and lay same at a unit price per thousand.

Brick Lining for Smoke Stacks and Ash Hoppers.

The Contractor shall furnish the brick linings for the entire height of the four smoke stacks, and about 150 M. brick for lining of ash hoppers, which shall be of hard burned brick. The

lining shall be 4″ thick, laid in lime mortar and backed with one inch of Portland cement mortar.

4. Face Brick, Exterior and Interior:

The entire exposed exterior surfaces of the four building walls from the level of the top of the granite sill course up to the roof copings, shall be faced with an approved "iron spot" buff colored brick, which is to be equal to a brick to cost thirty-five dollars per thousand, to be selected by the Company.

Enameled brick is to be used for all areas described in the following:

(1) The areas of the four walls enclosing the pump room and the two tank rooms in the basement of the Boiler House.

(2) The exposed surfaces of the walls of the exciter room on the main floor at the northerly side of the operating room.

(3) The surfaces of the walls of the stair halls on each of the six northerly electrical mezzanines, including the walls of the stair halls on the main floor and battery floor level at the easterly end.

(4) The surfaces of the four walls enclosing the stair and elevator halls on each of the six northerly electrical mezzanines at the westerly end, from the first to the sixth mezzanines inclusive, and also from the mezzanine battery floor level up to the main floor. The walls of the stair and elevator hall on the main floor to have other finish as hereinafter specified.

The surfaces of the inside of the walls enclosing the bus rooms and bus tie rooms on the first mezzanines, the oil switch rooms on the second and fourth mezzanines, the transformer rooms on the third mezzanine and the cable room on the fifth mezzanine, exclusive of all stair halls, shall be faced with a first quality vitrified, wire cut, shale buff brick, equal to a brick to cost thirty dollars per thousand, brick to be selected by the Company.

All enameled brick to be a first quality American size white enameled brick, to be selected by the Company.

All face brick for the exterior and interior surfaces of walls to be built from floor to ceiling and to be returned at all window and door jambs, and around all pilasters and breaks in walls, showing no joints between common and face brick. Face bricks are to be gauged, squared and selected before same are built into walls; no blistered or "off colored" brick is to be used.

All brick to be laid up in Portland cement mortar as hereinafter specified under "Mortar." Joints for all exterior brick are not to exceed 3-16″ in thickness, and for interior brick, are not to exceed ⅛″ in thickness. All joints in all face brickwork to be pointed up with "Peerless" (or equal) mortar stain of such tints to be determined by the Company.

The surfaces of the four building walls of the first and second boiler rooms shall be faced with a first quality American size white enameled brick.

All arched openings throughout, both for exterior and interior, shall be ground brick arches, to be well bonded through the walls and accurately formed to the radius shown on drawings.

5. Mortar for Brickwork:

The mortar used for all walls throughout shall be the best grade of Portland cement, with one part of cement to three parts of clean, sharp sand. The Portland cement used for this mortar and for the before mentioned concrete work shall be a well-established brand of American make, as approved by the Company. It is to be moderately slow setting and should weigh from 106 to 112 lbs. per struck bushel, not less than 98 per cent. fine, using a 2,500-mesh sieve, and after one day in air and six days in water, it shall sustain without rupture 500 lbs. per square inch of section when tested neat. Mortar shall only be made in batches sufficient for immediate use and none used that has commenced to set. All proportions of sand and cement shall be made by measure and not by weight. All cements shall

be plainly marked for identification and all cements shall be stored under a water-tight roof. No cement shall be used that has caked in the barrel or otherwise deteriorated in the slightest manner. All sand shall be clean, sharp and dry and free from loam, and the mortar shall be thoroughly mixed with only enough water to render it sufficiently plastic. All face work shall be laid up in cement and putty mortar, colored with "Peerless" or equal mortar stain as directed, and with flush struck joints.

6. Granolithic Floor and Sidewalk Finish, Etc.:

Provide and lay a hard and durable granolithic finish for the following areas:

(1) The entire area of the basement floor in the Boiler House and Engine Room, including the pump room, machine shop and tank rooms and the bottoms and sides of all trenches in floor, so as to form a continuous unbroken surface from one end of the building to the other.

(2) The areas of the toilet rooms, blower room and locker rooms in vault under the First Avenue and 40th Street sidewalks.

(3) The entire areas of the first and second boiler floors, exclusive of the areas under the boilers and any other openings in floors wherever indicated on drawings that arch work is not to be provided.

(4) The entire areas of the third or coal bunker floor wherever masonry archwork is to be provided.

(5) The areas of the floors, sloping sides and vertical partitions of all coal bunkers on the third floor.

(6) The entire area of the cable space in the basement of engine room, under the battery room, and the cable vault under the 40th Street sidewalk.

(7) The entire areas of such portions of walkways in Boiler House monitor wherever indicated on drawings that masonry archwork is to be provided.

(8) The treads, risers and platform of basement entrance stair area on 40th Street near First Avenue. The treads are to be provided with lead and steel safety treads which are to be supplied by another Contractor as hereinafter specified, and the granolithic finish on concrete steps shall have depressions moulded in same to receive the safety treads.

(9) The entire areas of the three sidewalks on First Avenue, 39th and 40th Streets.

(10) The entire area of the floor of the duct mezzanine between the exciter room and the battery room at the northerly side of operating room.

(11) The areas of all of the blower platforms in boiler house.

(12) The areas of all of the concrete walkways over boilers.

All sidewalk and floor finish, including area steps and platform, shall be no less than two inches thick, of an approved granolithic mixture, which shall in all cases be evenly and smoothly laid, and be provided with a roller finish.

Sidewalks shall be properly graded with an even pitch to curbs.

7. Masonry Floor, Sidewalk and Roof Arch Construction:

The Contractor shall provide the floor, sidewalk and roof arch construction for the following areas and also wherever indicated on drawings:

(1) The entire areas of the first and second boiler rooms, exclusive of such areas under the boiler settings and other openings shown on drawings, and specifically stated on drawings as not to be provided.

(2) The floor areas of the three electrical mezzanines at the westerly end of operating room.

(3) The entire floor areas of the six electrical mezzanines at the northerly side of the operating room for the entire length of the operaing room between the easterly and westerly building walls, including all stair halls.

(4) The floor areas of the office, vestibule and entrance stair lobby at the main floor level under the mezzanines at the westerly end of the operating room.

(5) The floor areas of the exciter room and stair and elevator halls, at the main floor level under the electrical mezzanines at the northerly side of the operating room between the easterly and westerly building walls.

(6) The floor areas of the entire third floor (or coal bunker floor) of the Boiler House, exclusive of such areas shown on drawings as not to be provided.

(7) The entire areas of the floor and sloping sides of all of the coal bunkers on the third floor of the Boiler House.

(8) The floor areas of the battery room and stair and elevator hall, located on the mezzanine floor between the basement and main floor, at the northerly side of the operating room, for the entire length of the building, between the easterly and westerly building walls.

(9) The entire areas of the floor of the duct mezzanine between the exciter room and battery room, for the entire length of the operating room at the northerly side.

(10) The entire areas of the mansard roofs and flat roof of the Boiler House.

(11) The entire areas of the roof over the operating room, including the roof over the electrical mezzanines at the northerly side of the operating room.

(12) The entire areas of the sidewalks over the vaults on First Avenue and 40th Street.

(13) The areas of all blower platforms and walkways over boilers.

(14) The areas of the mezzanine floor under 40th Street sidewalk at the northwest corner.

The masonry archwork shall consist of solid concrete slabs in flat or segmental shapes, re-enforced with expanded metal, wirecloth, wire strands or steel bars, and whatever construction the Contractor shall employ for the performance of the works shall first receive the approval of the Company, and shall in addition, conform with the Laws and Ordinances relating to Buildings in the City of New York. All archwork must be of sufficient strength and must be guaranteed to safely carry the uniformly distributed "live" loads as called for by the plans, in addition to the "dead" loads or weight of floor construction proper. The cement used in the construction is to be the best brand of Portland cement of American make that will be satisfactory to the Company.

The bottom flanges of the floor beams of the six electrical mezzanines on the northerly side of the operating room and the three office mezzanines at the westerly end of the operating room including the locker rooms and toilet rooms in the vaults under the sidewalks, are to be provided with substantial fireproof beam coverings to be approved by the Company.

The Contractor shall provide the cinder concrete filling over the archwork of all floors, mezzanines, roofs and sidewalk. The cinder filling over the archwork in the case of all floors, shall be finished up to within two inches of the finished floor levels. The cinder filling over roof arches to be graded to outlets as indicated on plans.

The cinder concrete filling shall consist of Portland cement (as hereinbefore specified), clean sharp sand, and clean steamed cinders, to be mixed in the proportion to be approved by the Company. Tops of arches shall finish flush with tops of beams.

8. Granite:

The entire base around the four walls of the building, from a level below the grades of the sidewalks as shown on drawings up to a point about eight feet above the level of the first mezzanine, shall be constructed of an extra quality of "Milford Pink" granite (or equal) to be selected by the Company.

Granite shall be of carefully selected stock and shall be free from all imperfections, such as sap, mineral stains or other discolorations, and shall be of an even shade throughout, so that one stone shall not look of a different shade from another when set in place.

The rusticated blocks and recessed joints, water-table, window-sills and sill course, cornice, bases to brick piers above cornice, the architraves around entrance on First Avenue and the entrance to operating room on the river end, the key blocks over all arched openings, the face of all steps and door sills, including the sides and top surfaces of the buttresses at each side of First Avenue entrance, and the walls at each side of the entrance on the river end of the building, shall be hammered "eight-cut" work. The top surfaces of all steps, platform and door sills shall be hammered "six-cut" work.

The finish of all stonework shall include the surfaces of the jambs of all openings.

Provide a granite curb 8″x24″ for the three sidewalks on First Avenue, 39th Street and 40th Street. Curbs shall have rounded top edge and shall be hammered "four-cut" work.

All carved work shall be executed by skilled workmen, and shall be in strict accordance with full size details which will be supplied at a later date.

Plaster models shall be submitted to the Company for approval before commencing the work.

All windows and doors sills shall be washed and lugged.

All courses of granite shall be top leveled before the next course is begun and they shall be properly set and leveled on well prepared beds of Portland cement mortar of a brand and mixture as hereinbefore specified under "Mortar."

Projecting courses shall have drips formed on the underside.

All joints shall be raked out to a depth of one inch and shall be repointed with Portland cement mortar well driven into the joint and finished with a smooth raised joint.

The Contractor shall do all lewising, fitting and other jobbing required for setting the stone, or to receive the iron ties, anchors, clamps, etc.; and shall provide all patterns required for the execution of the work; and all of the work shall be cleaned down with muriatic acid and water and wire brushes in a thorough manner at the completion of the building.

9. BLUESTONE:

The inside sills of all windows throughout the building and the copings under monitors at the river end of the building, shall be provided of a first quality North River bluestone of uniform color and texture and free from imperfections of any and all kinds. The exposed surfaces of all bluestone shall be rubbed.

All bluestone shall be cleaned down with water and wire brushes in a thorough manner at the completion of the building.

10. TERRA COTTA TRIMMINGS:

The material for all terra cotta work shall be of carefully selected clay, left in perfect condition after burning and uniform in color. All pilaster caps and neck moulds, label moulds over arched window openings, key blocks, cornice, copings, dormers, panels, etc., wherever marked on drawings, shall be ornamented and shall be carefully modeled by skilled workmen, and all work shall be in strict accordance with details to be supplied later. All projecting courses shall have drips formed on the underside. The terra cotta blocks shall be provided with interior partitions as often as may be required to prevent warping and to secure a substantial job. Partitions

shall have numerous holes cast in them to form a clinch for the mortar and brickwork used for filling. No spalled, chipped, glazed or warped pieces of terra cotta will be accepted. Terra cotta blocks shall be built up in advance of the brick backing one course at a time, and all voids filled with brick and mortar. As soon as the blocks are set, the joints shall be raked out to a depth of ¾". After the walls are up, all joints shall be repointed with Portland cement mortar well driven into the joint and rubbed smooth with the jointer. The Contractor is to furnish a sufficient number of over pieces to offset any liability of breakages. All terra cotta work shall be of "Pompeian" terra cotta. All terra cotta work shall be provided with a sufficient number of galvanized iron anchors for thoroughly anchoring same into the walls. The entire work shall be cleaned down with water at the completion of the building.

11. LATHING AND PLASTERING:

The ceilings of the office, vestibule, entrance lobby and the six offices, toilet room and two corridors on the upper mezzanines at the westerly end of the operating room and the ceilings of the elevator and stair halls on the seven mezzanines in the northwest corner of the operating room, shall be furred with 1¾" x 1¾" iron angles spaced 12" apart and substantially secured to the bottom flanges of the beams and girders with galvanized wrought iron hooks or clamps; upon the underside of this furring, and securely fastened thereto, shall be applied a stiffened galvanized wire lathing of No. 20 gauge wire and 2½ x 2½ mesh.

The ornamental plaster cornices in the vestibule, entrance lobby, and stair and elevator hall at the westerly end of operating room, and the offices, toilet room and corridors on the first and second mezzanines, shall have galvanized wrought iron brackets spaced about 12" apart, on which is to be applied the galvanized lathing as hereinbefore specified.

The lathing shall be tightly stretched and secured to the furring with galvanized lacing wire at frequent intervals, and the lathing shall be well lapped on walls.

The lower flanges of all of the floor beams and girders of the seven electrical mezzanines, including the ceiling of the battery rooms, at the northerly side of the operating room, shall be wrapped with wire lathing as hereinbefore specified.

Plastering shall be provided for all areas described in the following:

(1) The ceiling in the entrance lobby.

(2) The ceilings and walls of the office on main floor, and the six offices and toilet room on the upper mezzanines at the westerly end of the operating room.

(3) The ceiling of the entrance vestibule on main floor.

(4) The ceilings and walls of the battery rooms.

(5) The ceilings of the seven mezzanines, which includes the exciter room, bus rooms, bus tie rooms, cable room, transformer rooms, oil switch rooms, stair halls, stair and elevator halls, at the northerly side of the operating room, from the east to the west walls.

(6) The entire area of the underside of the roof over the operating room.

(7) The ceiling of the stair and elevator hall at the level of the battery room, between the basement and main floor, at the northwest corner of the operating room.

(8) All of the tile partitions enclosing the coal bunkers on the third floor in Boiler House.

(9) All of the tile partitions in monitors on the roof of the Boiler House.

(10) The ceiling and side walls of the unassigned space on the sixth mezzanine.

The Contractor shall provide the Portland cement scratch coat at least 1″ thick on all walls where faience or glass tile is specified as described in clauses No. 35 and No. 36. This

coating shall be evenly and smoothly applied with sufficient force to give a good clinch and shall be well scratched.

The arrises of all pilasters, ceiling beams, girders and other projections, shall have ruled joints.

All plastering shall be applied in three coats of the "King's Windsor" or "Adamant" cement plaster, mixed in the proper proportions.

The scratch coat shall be properly applied with sufficient force to give a good clinch, and shall be well scratched. Apply the brown coat as soon as the scratch coat is two-thirds dry or has set sufficiently to receive it, bringing the mortar out even with the grounds and to a true surface.

After the brown coat is two-thirds dry, finish all work throughout with a white coat trowelled and brushed to a hard and uniform surface.

All masonry walls shall be wetted down before plastering.

Only as much mortar as can be used within one hour shall be mixed at one time, and under no circumstances, shall any mortar that has commenced to set be retempered.

The cornices shall be enriched with egg and dart, dentils and beaded members.

The finish coat for the cornices shall be composed of two parts of plaster of Paris to one of lime paste.

All mouldings shall be "run" in by hand and shall be in strict accordance with full size details to be supplied later.

All enriched members shall be cast and applied with liquid plaster of Paris. All plastering shall be executed in a thorough and workmanlike manner, subject to the approval of the Company.

The Contractor shall do all patching up after other trades, and shall leave the work in a perfect condition at the completion of the building.

12. Terra Cotta Partitions:

All terra cotta partitions wherever marked on drawings shall be constructed of hollow porous terra cotta tile, thorough-

ly burned and free from serious checks, cracks or other damages, and all tile shall be laid with breaking joints in a proper and workmanlike manner, and set in Portland cement of a brand and mixture as hereinbefore specified under "Mortar."

The blocks shall be started directly upon the masonry filling of the floor construction, and shall be built plumb and firmly wedged with slate at the ceiling.

Provide 3″ x 12″ x 24″ terra cotta roof blocks for the roofs of all dormers, and the flat roofs over the monitors of the boiler house at the smoke stacks.

Iron buck stays shall be provided as specified under "Ornamental Iron."

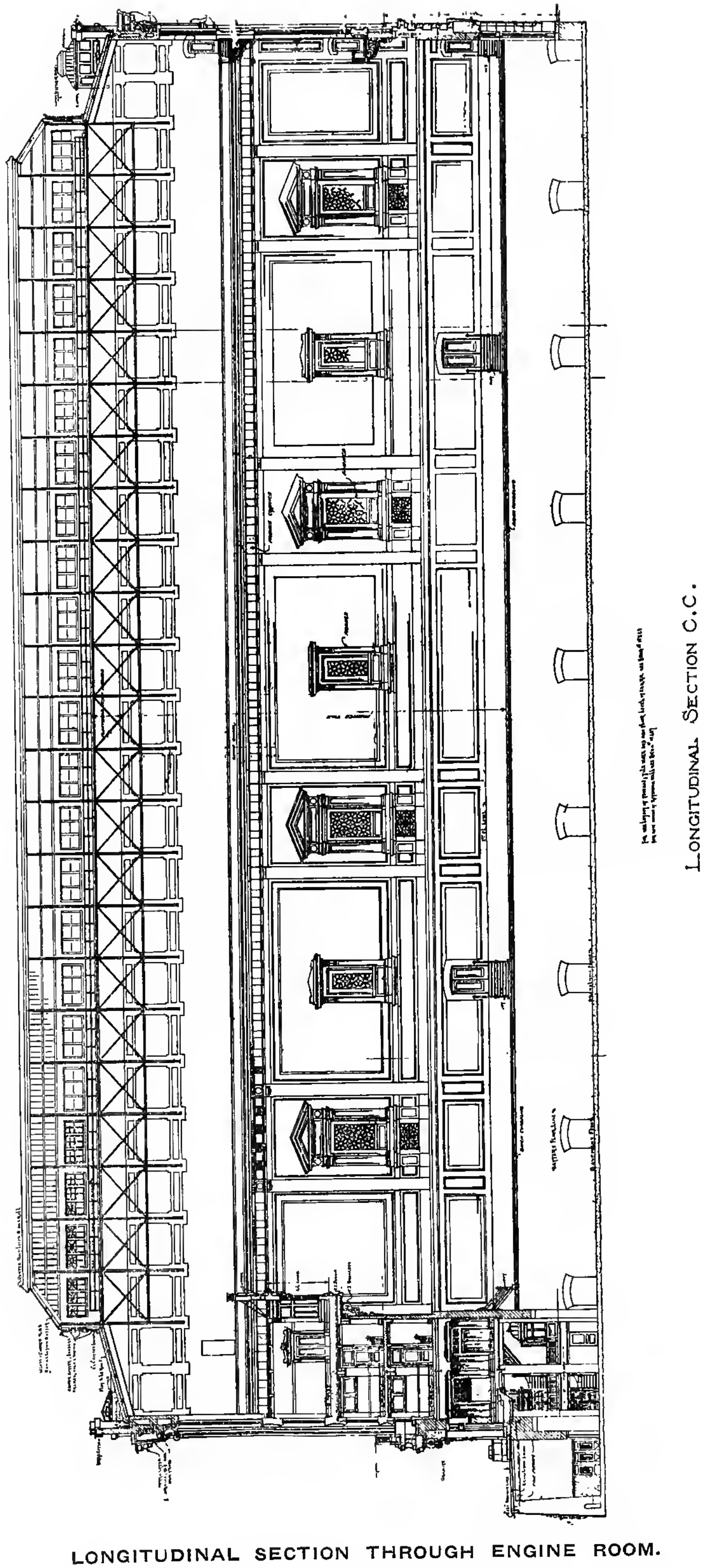
13. WATERPROOFING:

The top of the arches and beams of the First Avenue and 40th Street sidewalks, the outside surfaces of the concrete walls of the vaults under the First Avenue and 40th Street sidewalks and the outside surface of the easterly wall of the building shall be thoroughly waterproofed by the application of an approved brand of Trinidad Lake asphalt with at least five layers of No. 1 vulcanite roofing felt, lapping each successive layer at least two-thirds of its width over the preceding layer. The waterproofing shall be laid over the sidewalks and back of the granite curbs and over the surfaces of the vault walls down to the bottom of the foundation work below basement floor level.

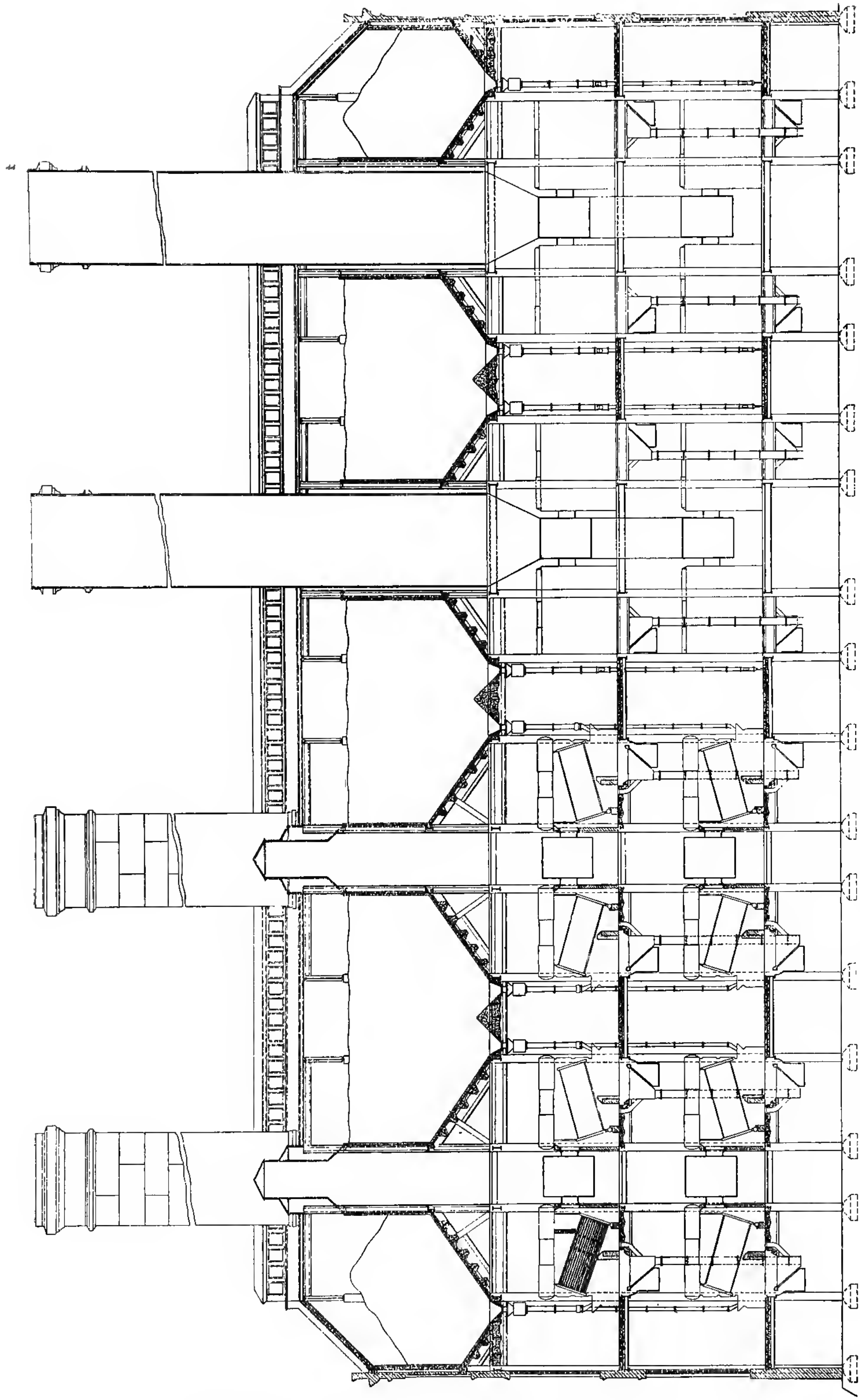
The waterproofing for the easterly wall shall be started at a point just below the finished grade and shall continue down to the bottom of the foundation work below basement floor level.

The waterproofing of the southerly wall in basement will be provided under separate contract.

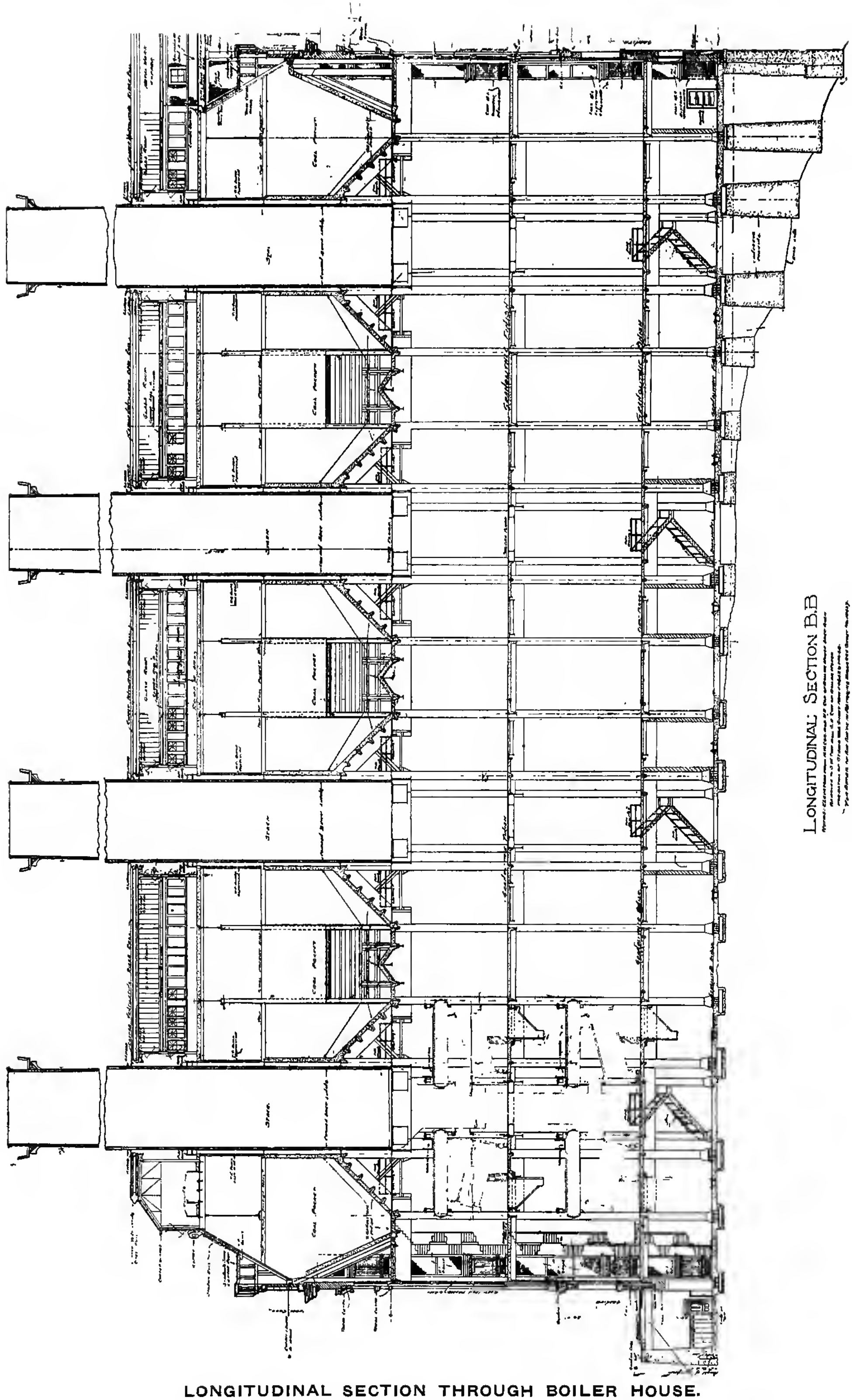
Waterproofing shall be done in a thorough manner satisfactory to the Company.



LONGITUDINAL SECTION THROUGH ENGINE ROOM.



LONGITUDINAL SECTION THROUGH BOILER HOUSE.



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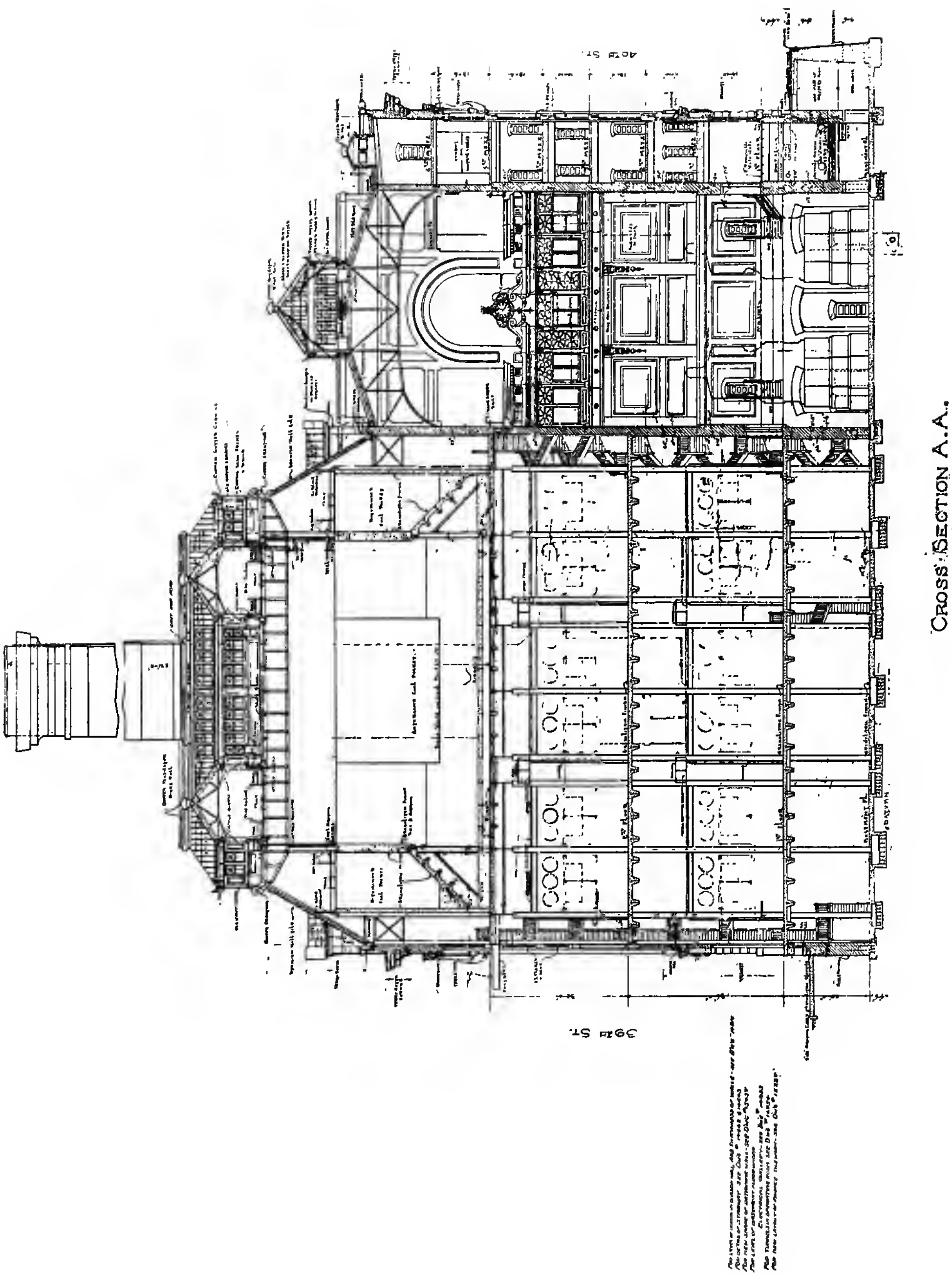
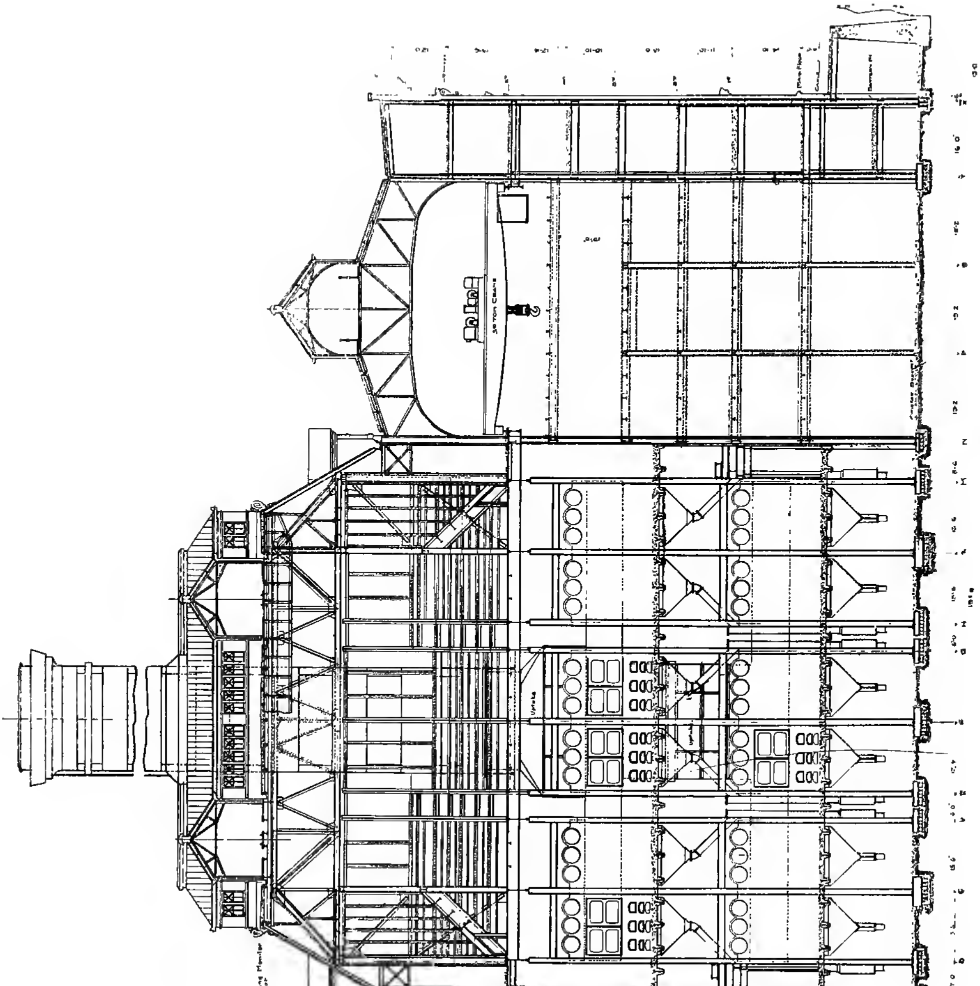


CROSS SECTION.



CROSS SECTION.

14. Cement Coating over Waterproofing:

The waterproofing over the vault walls and the easterly building wall shall receive a coating of Portland cement and sand at least one inch in thickness and troweled to a smooth and even surface. The coating shall consist of one part of cement to three parts of clean sharp sand. The brand of Portland cement shall be as hereinbefore specified under "Mortar."

15. Patent Flooring:

Provide and lay a patent flooring for all of the areas where-ever marked on drawings and described in the following:

(1) The floor area of the six offices, toilet room and two corridors located on the first and second mezzanines at the westerly end of the operating room.

(2) The floor areas of the stair and elevator halls from the first to the sixth mezzanines inclusive and the stair and elevator hall at battery room level.

(3) The floor areas of all of the stair halls wherever marked on all of the mezzanines at the northerly side of the operating room.

(4) The floor areas of the high tension switchboard room located on the third mezzanine at the westerly end of operating room.

(5) The floor areas of the transformer rooms, oil switch rooms, bus rooms, bus tie rooms, including the floor area of the unassigned room, located on all of the mezzanines at the northerly side of the operating room.

(6) The floor area of the office on the main floor adjacent to the entrance vestibule at the westerly end of the operating room.

The flooring shall be of "asbestolith," "Taylorite," "hydrolith-cement" or other patent flooring composed of a similar material to be selected by the Company.

Sanitary bases for all areas where patent flooring is specified shall be provided of the same material as used for floors and shall be 10″ in height.

The Contractor shall provide 1½″ of cement filling under all patent floors throughout. Flooring shall be equal to the best standards of construction applying to this class of work.

16. MARBLE:

The Contractor shall provide and set all of the marble work described in the following:

(1) The surfaces of the walls, columns, pilasters and piers, and the door and window jambs and trim and room bases of the vestibule, entrance lobby and the stair and elevator hall located on the main floor level at the westerly end of the operating room.

The marble work shall be provided from the level of the finished floor up to the underside of the plaster cornices and the bronze pilaster and column caps.

The marble shall be provided along the walls in back of stairs and elevator shaft. Marble shall be the "Poanazza," "Numidian" or equal marble in as large slabs as can be conveniently quarried and handled, and no less than 1½″ in thickness.

(2) The partitions enclosing the shower baths and the sides, backs and jambs of all water-closet apartments and urinals in the toilet rooms in vaults under the First Avenue and 40th Street sidewalks and the toilet room on the first mezzanine at the westerly end of the operating room, shall be of marble 7 feet in height and 1¼″ thick. The slabs and jambs dividing the water-closet compartments shall be raised 10″ above the floor. The division slabs between urinals shall have quarter-circle openings of 10″ radius at the bottom of slabs at floor.

Provide a moulded trim 2″ x 5″ on top of water-closet slabs at the front and marble shelf slabs on top of urinal partitions at the back against walls.

End partitions of water-closet apartments and urinals shall be carried down to floor.

Floor slabs under all urinals, shower baths and wash-basins shall be of marble suitably countersunk and set flush with finished floor and provided with suitable openings for drains. Provide for the front of each individual shower, marble floor curbs 1½" thick with rounded edges, set 3" above finished floor and securely imbedded in the cement filling of floor.

(3) Bases for all toilet rooms, locker rooms and blower rooms in vaults under sidewalks shall be sanitary bases of marble 12" high by 1" in thickness and have chamfered edge.

Saddles for doors opening into all toilet rooms, locker rooms and blower rooms in vaults under sidewalks and the toilet room on first mezzanine shall be of marble 1½" thick by the full width of jambs and shall project ⅝" above finished floor levels and be provided with chamfered edges.

(4) Saddles for doors between the operating room and the office, entrance lobby, exciter room and stair halls on the main floor, and all doors between the offices, entrance lobby, entrance vestibule, exciter room, bus rooms, bus tie rooms, cable rooms, oil switch rooms, transformer rooms, stair halls, corridors, stair and elevator halls, high tension switchboard room, unassigned room, etc., on all of the northerly and westerly mezzanine floors in the operating room, shall be of "Pink-Tennessee" marble 1½" thick by the full width of jambs, and shall project ⅝" above finished floor levels and be provided with chamfered edges.

(5) The treads and platforms for all of the five lines of stairways connecting all mezzanine floors at the northerly and westerly sides of the operating room, from the level of the battery room floor up to the sixth mezzanine floor, inclusive; also the steps and platform in the entrance vestibule on main floor shall be of "Pink Tennessee" marble.

Treads shall be 1½" thick by 10" wide and the platforms 1½" thick by the full width of stairs, and the treads and plat-

forms shall have chamfered nosings and be securely connected to the iron stair strings and risers in a thorough manner.

All marble herein described shall be of the best grade of "Tennessee" marble free from any and all imperfections and of uniform color and texture, and set up in Portland cement.

All marble not specified to be of "Pink Tennessee" shall be of "Gray Knoxville Tennessee" marble. Marble shall be selected by the Company.

17. MOSAIC:

The flooring of the main entrance vestibule, entrance lobby and the stair and elevator hall on main floor under the westerly mezzanines shall be of white marble mosaic with a decorative border of colored marble mosaic of a Greek "fret" design, mitering at all pilasters and breaks, and around all piers and columns, and the stairs and elevator enclosure.

A seal or monogram of the Company, about 30″ in diameter, shall be provided of colored mosaic for the center of the floor of the lobby.

Mosaic shall be laid in Portland cement and must be level and smooth throughout.

18. FAIENCE TILE:

The entire exposed surfaces of the walls of the operating room, from the level twenty feet above the finished basement floor up to the underside of the roof arches, and the exposed surfaces of the walls enclosing the high tension switchboard room on the third mezzanine floor at the westerly end of the operating room shall be provided with "Grueby" glazed faience tile.

The wainscoting or base, from the operating room floor up to the level of the first mezzanine, shall be built out 8″ beyond the face of the walls above and shall be in two shades of green; the ground shall be of the darker shade and the panels shall be formed of the lighter shade of green.

For the space between the top of the wainscoting up to the underside of the crane girders, the ground shall be of white tile, and the panels formed of purple tile.

The space between the top of the cornice under the crane girders up to the underside of roof arches shall have a ground of white tile and the panels between roof trusses of gray or purple tile.

The pilasters, pediments, architraves and the continuous ornamented cornice under the crane girders for both sides and ends of the operating room shall be of a gray glazed faience.

The walls of the high tension switchboard room on the third mezzanine shall have a ground of white tile with the panels formed of purple tile; the moulded architrave around door opening and the base around room shall be of purple glazed faience.

All tile work shall be set in Portland cement, and shall return around all pilasters and breaks in walls, and into all door and window openings.

All glazed faience and tile work shall be executed in a thorough and skilful manner throughout, and shall be in strict accordance with the full size details which the Company will furnish at a later date.

All tile shall not be over 4½" x 9" and 1" thick.

The Contractor shall submit for approval, scale or full size models in color of any or all portions of the work that the Company may require.

19. Glass Tile:

The surfaces of vault walls, building walls, partitions and ceilings of all of the toilet rooms, locker rooms and blower room in the vaults under the First Avenue and 40th Street sidewalks and the surfaces of the walls of the two corridors and toilet room located on the first and second mezzanines at the westerly end of the operating room, including the wall and two I beams of the stair area on 40th Street, shall be provided with a first quality glass tile 3" x 9" in size.

The surfaces of the back of tiles shall be pebbled to form a key for the Portland cement backing in which all tile shall be set.

Tile shall be provided from floor to ceiling in all cases, and shall follow the curve of the underside of the sidewalk arches over the toilet rooms, locker rooms and blower room in vaults, and around all beams and girders.

Tile work shall continue around all pilasters and breaks in walls and into all door and window-jambs.

The arises of all pilasters, jambs, beams and girders shall be provided with ¼ round glass tile securely bonded with tile on the walls.

20. INTERLOCKING RUBBER TILE:

The entire area of the floor of the high tension switchboard room on the third mezzanine shall be the best quality of interlocking rubber tile with colored borders mitring around all breaks in walls.

CARPENTER WORK.

21. CENTERS FOR ARCH WORK:

Furnish strong yellow pine centers for erecting the masonry floor arches and also for all arched window and door openings throughout. Centers shall be constructed of about 2″ x 4″ scantling and 2″ planks laid close together and dressed on one side, and shall be left in place until the masonry has set.

22. FURRINGS, GROUNDS, CUTTING AND JOBBING:

Furnish all grounds, furrings, brackets, etc., for metal flashings, gutters, etc., and all blocking required to secure any portion of the other work of the building.

All cutting and jobbing that may be required shall be executed by the Contractor, and all iron anchors, straps, bolts,

etc., that may be necessary or required in connection with carpenter work shall be furnished.

23. Doors and Sash, and Rough Hardware:

Provide panelled oak dwarf doors for all water-closet apartments and the oak doors for battery room. Doors to battery room shall be provided with rabbeted jambs and 5″ moulded trims on both sides. All work to be quartered oak.

The Contractor shall furnish substantial temporary doors and sash for all door and window openings as may be directed by the Company.

All finished stone, terra-cotta and brickwork shall be protected with yellow pine planks.

Furnish complete and substantial rough hardware for all temporary work throughout the building.

24. Sleepers:

Furnish 1½″ x 3″ beveled yellow pine sleepers imbedded in the cement filling over the archwork of the entire mansard roof of the Boiler House for securing the Spanish roll tile thereto.

Sleepers shall be spaced about 13″ on centers.

KALAMEIN COPPER AND IRON.

25. Kalamein Copper Doors, Jambs and Trim:

Furnish and hang all of the kalamein copper doors, jambs, and trim as described in the following:

Battery Room Floor Level:

(1) *Outside Entrance from Area Stairs.*—1-4′ 0″ x 8′ 6″, hinged, 2½″ thick, solid and glazed panels, rabbeted jambs 2″ x 8″, staff mould 1½″ x 1¾″, inside trim 6″ wide.

Fourth Mezzanine:

(1) *Between Vestibule and Lobby.*—1 pair 6′ 0″ x 8′ 0″ hinged, double swing 2½″ thick, solid panels, transom hinged, jambs 2″ x 10″, jamb stops ⅝″ x 2½″.

(2) *Between Office and Vestibule.*—1-3′ 6″ x 8′ 0″ hinged, 2″ thick, solid panels, jambs 2″ x 10″, jamb stops ⅝″ x 2½″, trim one side 6″ wide.

(3) *Between Entrance Lobby, Office and Operating Room.*—2-3′ 6″ x 8′ 6″ hinged, 2″ thick, solid panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, staff moulds 1½″ x 1¾″, trim one side 6″ wide.

(4) *Exciter Room.*—2-3′ 0″ x 8′ 6″ hinged, 1¾″ thick, solid panels, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trims 6″ wide. 1-3′ 6″ x 8′ 6″, hinged, 2″ thick, solid panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, staff moulds 1½″ x 1¾″, trim one side 6″ wide. 2 pair 7′ 6″ x 9′ 6″ hinged, 2″ thick, solid panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, staff moulds 1½″ x 1¾″, trim one side 6″ wide.

(5) *Stair and Elevator Hall.*—1-3′ 0″ x 7′ 6″ hinged, 1¾″ thick, solid panels, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trim one side 6″ wide.

(6) *Division Wall Between B. H. and Operating Room.*—4-4′ 6″ x 9′ 0″ hinged, 2″ thick, solid panels, jambs 2″ x 8″ rabbeted, staff moulds 1½″ x 1¾″.

First Mezzanine:

(1) *Bus Rooms and Bus Tie Rooms.*—25-2′ 8″ x 8′ 6″ hinged, 1¾″ thick, solid panels, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

(2) *Offices and Toilet Room.*—6-3′ 0″ x 8′ 6″, hinged, 1¾″ thick, solid and glazed panels, transoms hinged, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

SECOND FLOOR AND SECOND MEZZANINE:

(1) *Oil Switch Rooms, Stair Halls and Lobbies.*—17-2′ 8″ x 8′ 6″, hinged, 1¾″ thick, solid panels, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

(2) *Offices.*—6-3′ 0″ x 8′ 6″ hinged, 1¾″ thick, glazed and solid panels, transoms hinged, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

(3) *To Grating Walkway.*—2-3′ 6″ x 8′ 6″, hinged, 2″ thick, solid panels, jambs 2″ x 8″ rabbeted, staff moulds 1½″ x 1¾″, trim (one side of one door) 5″ wide.

THIRD MEZZANINE:

(1) *Transformer Rooms and Stair Halls.*—17-2′ 8″ x 8′ 6″, hinged, 1¾″ thick solid panels, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

(2) *H. T. Switchboard Room.*—1 pair, 6′ 0″ x 8′ 6″, hinged, 2″ thick, solid panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, trim one side 6″ wide.

MAIN FLOOR:

(1) *Oil Switch Rooms and Stair Halls.*—17-2′ 8″ x 8′ 6″, hinged, 1¾″ thick, solid panels, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

THIRD FLOOR AND FIFTH MEZZANINE:

(1) *Cable Room.*—5-2′ 8″ x 8′ 6″, hinged, 1¾″ thick, solid panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

(2) *To Grating Walkway.*—2-3′ 6″ x 8′ 6″, hinged, 2″ thick, solid panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

SIXTH MEZZANINE:

(1) *Unassigned Room.*—2-3′ 6″, hinged, 2″ thick, solid panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, trims 5″ wide.

Monitors.

(1) *Walkways to Roof Boiler House.*—14-3′ 6″ x 8′ 6″, hinged, 1¾″ thick, solid and glazed panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, staff moulds 1¾″ x 1½″, trim one side 4″.

(2) *Walkways to Roof Operating Room.*—5-3′ 6″ x 8′ 6″, hinged 1¾″ thick, solid and glazed panels, jambs 2″ x 8″, jamb stops ⅝″ x 2″, staff moulds 1¾″ x 1½″, trims one side 4″ wide.

26. Kalamein Iron and Tin-Covered Doors, Jambs and Trim:

Furnish and hang all of the kalamein iron and tin covered doors, jambs and trim, as described in the following:

Basement:

(1) *Toilet Rooms, Locker Rooms and Blower Room.*—16-3′ 4″ x 8′ 0″, hinged 1¾″ thick, solid panels, jambs 1¾″ x 8″, jamb stops ⅝″ x 2″, staff moulds 1½″ x 1¾″.

(2) *Division Wall.*—9 pair 3′ 4″ x 8′ 6″ sliding tin covered doors 2½″ thick.

(3) *Machine Shop.*—2-5′ 4″ x 10′ 0″ sliding, tin covered doors 2½″ thick. 2-10′ 0″ x 12′ 0″ sliding, tin covered doors 3″ thick.

(4) *Pump Rooms, Heater Rooms.*—6-4′ 0″ x 8′ 0″ sliding, tin covered doors 2½″ thick. 12-10′ 0″ x 12′ 0″ sliding, tin covered doors 3½″ thick. 6-7′ 6″ x 10′ 0″ sliding, tin covered doors 2½″ thick.

Main Floor:

(1) *Division Wall.*—4-4′ 6″ x 9′ 6″ sliding, tin covered doors 2½″ thick.

Second Floor and Second Mezzanine:

(1) *To Grating Walkway.*—1-3′ 6″ x 8′ 6″ sliding, tin covered door 2½″ thick.

THIRD FLOOR AND FIFTH MEZZANINE:

(1) *To Grating Walkway.*—1-3′ 6″ x 8′ 6″ sliding, tin covered door 2½″ thick.

MONITOR BOILER HOUSE:

(1) *Monitor Walkways.*—32-3′ 0″ x 8′ 6″ hinged 1¾″ thick, solid panels, jambs 1¾″ x 6″, jamb posts ⅝″ x 2″, trims 4″ wide.

All kalamein doors shall have raised panels and panel mouldings, and the muntins of glazed panels shall be moulded.

The trim specified for doors to roof and walkways for both the boiler house and operating room monitors shall have plain trims and base blocks.

All other trim shall be moulded back band trims and moulded base blocks.

Entrance vestibule doors shall have double rails and stiles and raised panel mouldings.

The sizes given for tin covered sliding doors represent the masonry openings and the doors shall be of sufficient size to lap at least 3″ over the openings at sides and top, and shall be constructed of well seasoned 1″ narrow white pine tongued and grooved boards, laid diagonally and well nailed, and completely covered with tin.

The doors shall be hung on ball bearing steel trolley tracks, and be provided with wrought or malleable iron brackets, hangers, and all other fittings, and shall be provided with fusible links, etc., complete.

Sliding doors shall be of standard construction as adopted by the New York Board of Fire Underwriters.

27. INTERIOR WINDOW-FRAMES AND SASH AND PANEL BOXES:

The window frames and sash for interior partitions shall be constructed of kalamein copper as per the following:

All windows in interior partitions enclosing the offices on the first and second mezzanine floors at the westerly end of the operating room shall be double hung.

The windows in partitions enclosing the toilet room on the first mezzanine shall be high-up pivoted windows.

Pulley stiles and jambs shall be 1½″ x 6″. Double hung and pivoted sash, including transoms, shall be 1¾″ thick.

Sills of double hung windows shall be 3 feet above finished floor and the moulded transom bar shall be level with top of doors.

Pivoted transoms shall be provided over all double hung windows.

The Contractor shall provide the trim and glazed doors for 24 electric light switch panel boxes of sizes as per the following: 10-2′ 6″ x 4′ 0″, 1-2′ 6″ x 4′ 9″, 7-3′ 0″ x 4′ 8″, 2-3′ 0″ x 4′ 2″, 1-3′ 6″ x 4′ 6″, and 3-2′ 6″ x 5′ 4.″ Sizes given represent the outside dimensions of boxes and the trim shall be a moulded and mitred trim 6″ wide. Hinged doors shall be 6″ smaller all around than sizes given and shall be 1½″ thick glazed with ⅜″ polished plate wire glass fastened in frames with moulded beads. Trim and doors shall be of kalamein copper.

28. Interior Window Trim and Chair Rail:

Trim for windows in interior partitions shall be moulded back hand trims 5″ wide and moulded stools and aprons 6″ deep.

Chair rails for the offices shall be moulded 6″ wide and shall join with window stools and aprons.

Trim shall be of kalamein copper.

29. Enclosure for High Tension Switchboard Room and Timekeepers' Booth:

The ornamental kalamein copper partition at the front of the high tension switchboard located on the third mezzanine shall be constructed with moulded cornice, panelled pilasters with moulded caps and bases, panelled wainscoting and moulded wainscot capping, ornamental brackets, etc., as shown on drawing.

The partition shall have swell front and the design and detail shall be the same for both sides of partition.

The pilasters and frieze of cornices shall be provided with sunk panels and the wainscoting with raised panel mouldings.

All sash shall be 2″ thick provided with wide moulded vertical and diagonal muntins and shall be constructed to slide horizontally. The cornice and wainscotings, including the sash, shall be constructed to suit the curve of the swell front.

The ornamental clock frame and base shall be constructed entirely of 20-oz. copper and shall be substantially supported on the inside by wrought iron framework, secured to the steel framing of partition.

Framework shall be designed to support clock works and shall be drilled wherever required to secure same.

The back of the copper clock frame shall be panelled and a hinged door of the same diameter opening as dial shall be provided for access to clock works.

The steel I beams of the ceiling over the high tension switchboard room shall be encased with kalamein copper with sunk panelled soffits, and all sash shall be pivoted 1¾″ thick.

The timekeeper's booth located in the stair and elevator hall in the northwest corner of the operating room at the level of the battery room mezzanine floor shall be constructed of kalamein copper for both the inside and outside of booth.

Provide moulded cornice, panelled pilasters with moulded caps and bases, panelled wainscoting and dome ribbed roof.

The sash shall be 1¾″ thick and shall be arranged to slide.

The domed ribs of the glazed roof shall be formed of copper of double thickness and formed so as to carry weight of the glass.

Provide counter and sliding sash and the glazed panelled door and transom above.

30. General:

All kalamein work throughout shall be constructed of clear well seasoned white pine cores completely covered with 16-oz.

copper tightly drawn on the wood cores in a skillful and workman-like manner and shall be equal to the best known standards of construction applying to this class of work.

All kalamein work shall be constructed in strict accordance with the full size details which will be furnished by the Company at a later date.

HARDWARE.

31. Hardware:

The double entrance doors to vestibule and the door at bottom of area steps shall be provided with large ornamental store door handles with rabbeted front cylinder locks of bronze of special design and finish, and shall be hung on 8″ loose pin bronze butts, three butts to each door.

The double swing doors between vestibule and entrance lobby shall be hung on 12″ "Bommers" double acting spring hinges of bronze, two hinges to each door, and ornamental push plates and kick plates of bronze of special design and finish.

The double doors to exciter room on main floor and high tension switchboard room on third mezzanine shall be hung on 8″ loose pin bronze butts, two butts to each door, and shall be provided with bronze "Yale" office locks, bronze escutcheon plates, knobs, etc., of special design and finish.

All other single swing doors throughout shall be hung on 6″ loose pin bronze butts, two butts to each door, and shall be provided with bronze "Yale" office locks, escutcheon plates, knobs, etc. Hardware for all doors to offices, entrance lobby, office toilet room and the stair and elevator halls shall be of special design and finish, and the hardware for all other doors shall be plain with copper bronze finish.

Double doors shall be provided with mortised top and bottom slide bolts of bronze of substantial design.

All swing doors shall be provided with "Blount's" or equal liquid door checks of bronze.

The outside wrought iron and steel doors shall be provided with durable store door handles and locks with plate escutcheons of wrought iron.

The hinges and slide bolts for steel doors will be provided by ornamental iron contractor as hereinafter specified.

The double hung sash in all interior partitions shall be hung on 2½" overhead pulleys with copper chains and lead weights and provided with sash lifts and fasteners of bronze.

Transoms shall be provided with adjustable transom openers of bronze.

The sliding sashes in copper partitions enclosing the high tension switchboard room and the timekeeper's booth shall be provided with countersunk bronze sash pulls, catches, etc., complete. The pivot sash in ceiling of high tension switchboard room shall have bronze snap catches of substantial design.

The doors to water-closet apartments in all toilet rooms shall be provided with nickel plated brass spring hinges, door pulls and inside slide bolts, the slide bolts shall be connected to slotted nickel plated brass outside plates with the words "Occupied" and "Not Occupied" in black letters on white celluloid.

Provide 3" bronze hinges and bronze snap catches for the glazed hinged doors to the 24 electric light switch panel boxes specified in clause No. 44. Hinges and catches shall be of neat and substantial design.

The hardware shall be complete in every respect, of the best manufacture as selected by the Company.

SHEET METAL AND ROOFING.

32. MONITORS:

The monitors on the roofs of the boiler house and operating room shall be constructed with moulded gutter cornices, panelled pilasters, moulded sill courses and panelled curbs below window sills.

The stamped copper lion's head ornaments on cornices shall be provided at each pilaster. The bed moulds and architraves of cornices and the moulded sill courses shall break around all pilasters.

The cornices shall be set to a level line around monitors and shall be provided with an inner lining properly graded to all leader outlets, and shall be connected to the flashings over the tee irons of the skylights.

All sash throughout shall be pivoted at sides and shall be moulded and provided with moulded vertical and diagonal muntins as shown.

The copper work of monitors shall completely cover and be substantially secured to the structural steel framing and masonry blocks on both sides.

The smaller monitors on the roof over the northerly electrical mezzanines shall be similar in construction to the monitors hereinbefore described with the exception that the panelled pilasters in this case are not to be provided.

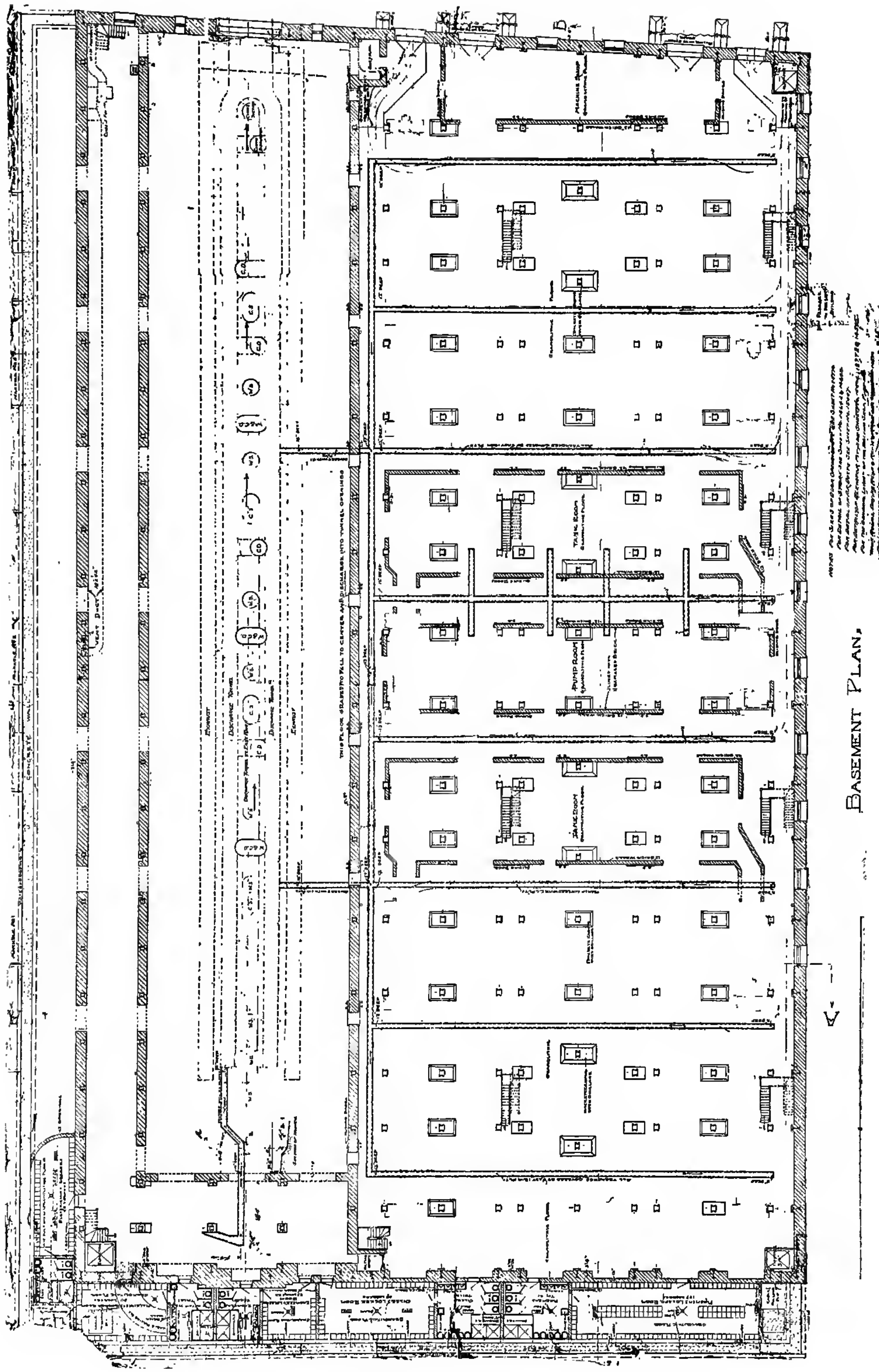
33. Skylights:

The 3″ x 3″ tee irons for the skylights over all monitors and elevator bulkhead shall be provided by the roofing contractor, together with the condensation gutters and cap flashings over same.

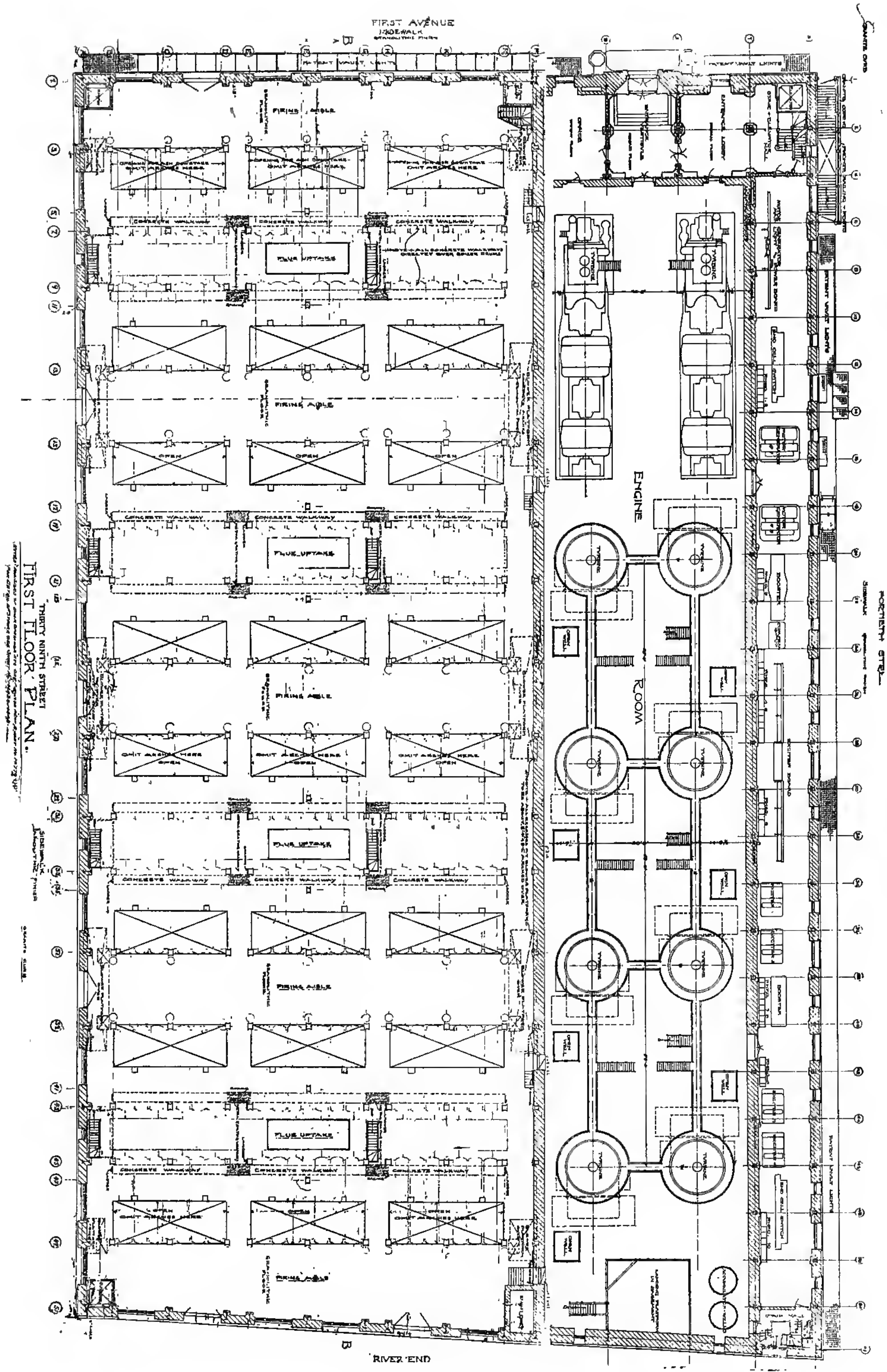
The tees shall be completely covered with copper and constructed so as to form a double condensation gutter at each rib, and shall be re-enforced in such manner to sustain the weight of the glass.

The cap flashings shall be formed around the edges of glass and flashed with sheet lead strips provided between the cap flashings and top of glass, and the caps shall be held in place by brass bolts and nuts.

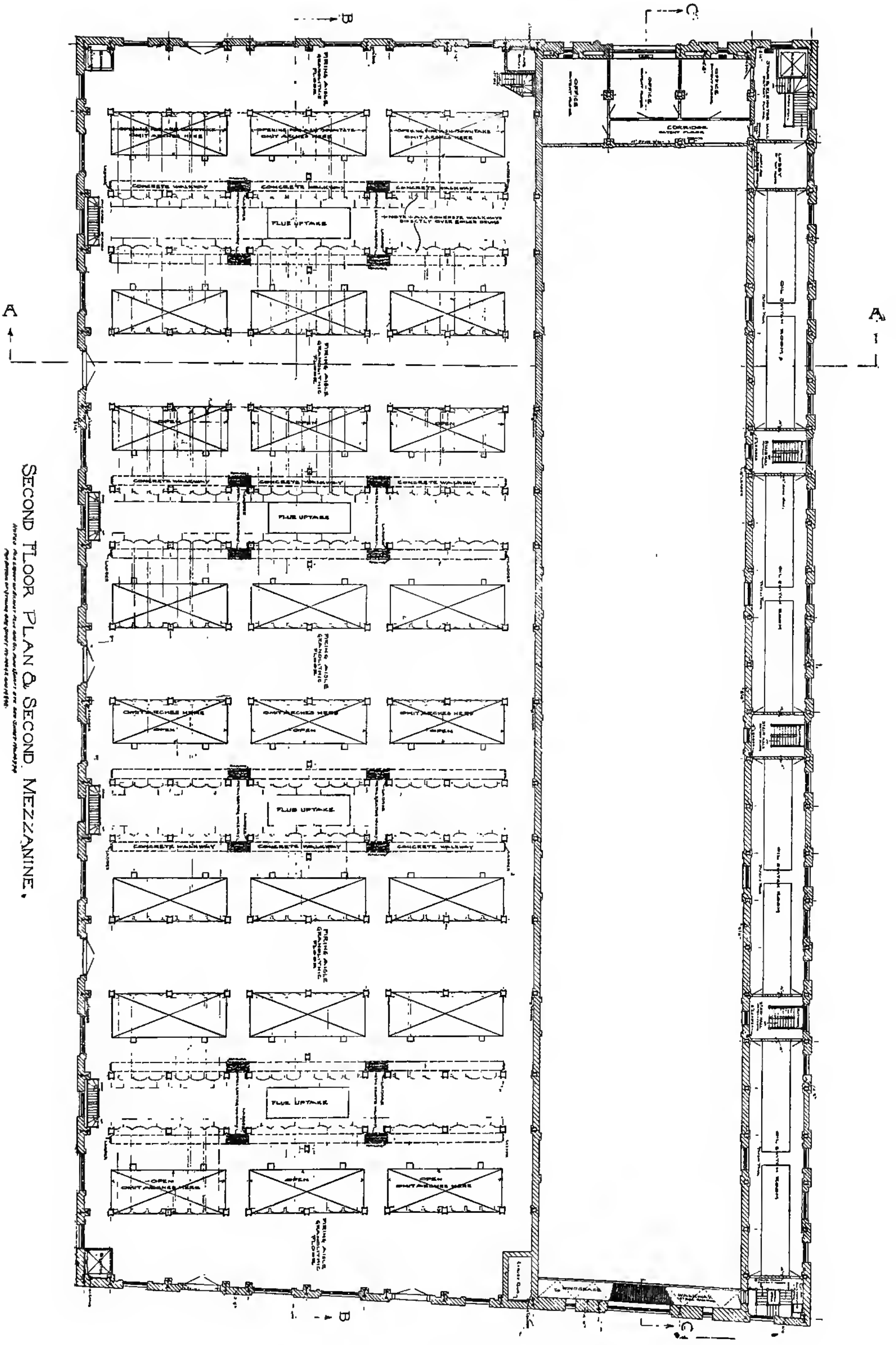
The condensation gutters and cap flashings shall be formed in such manner that no portion of glass will bear directly upon or come in contact with, the structural framing of the skylights.



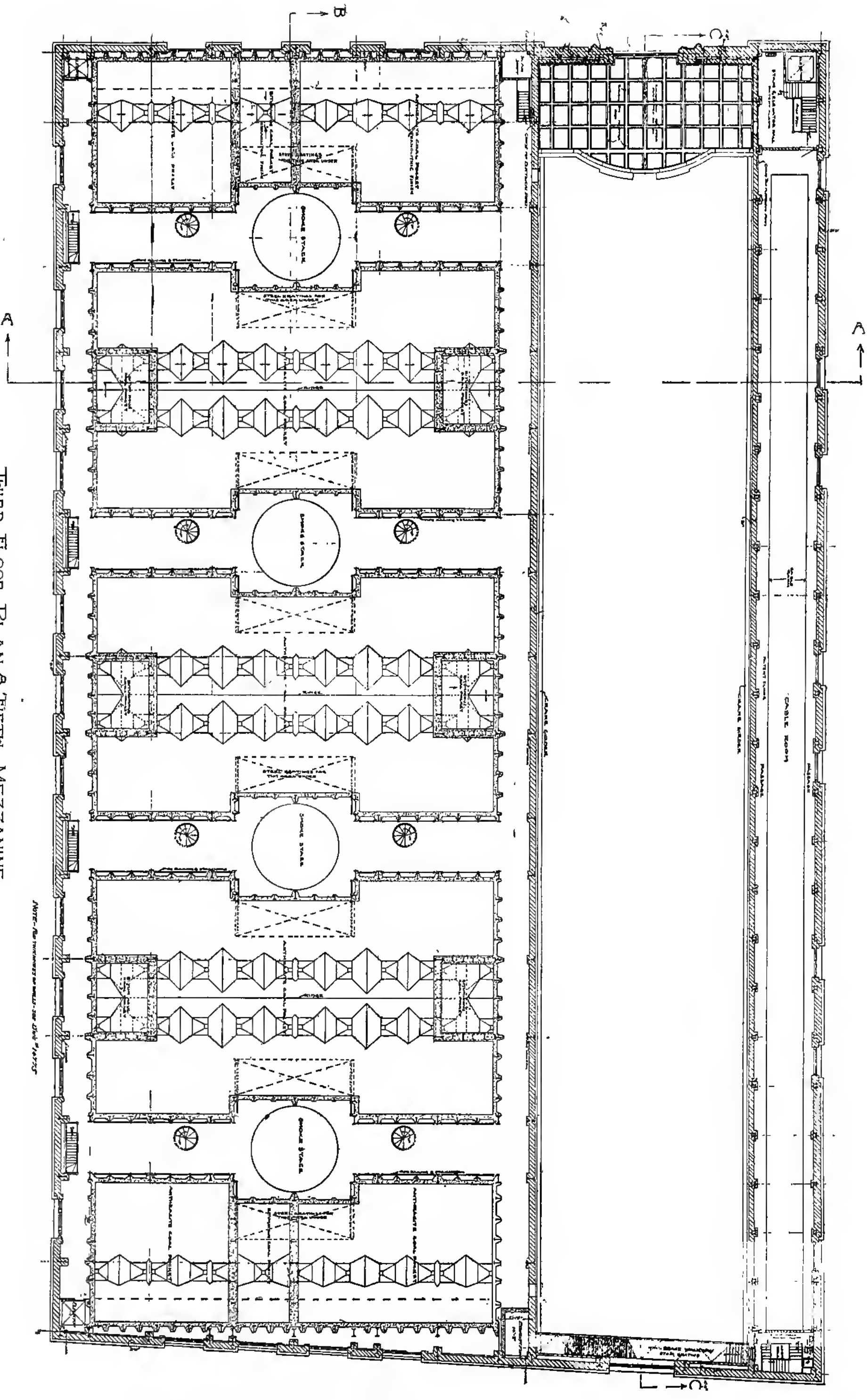
BASEMENT PLAN.



FIRST FLOOR PLAN.

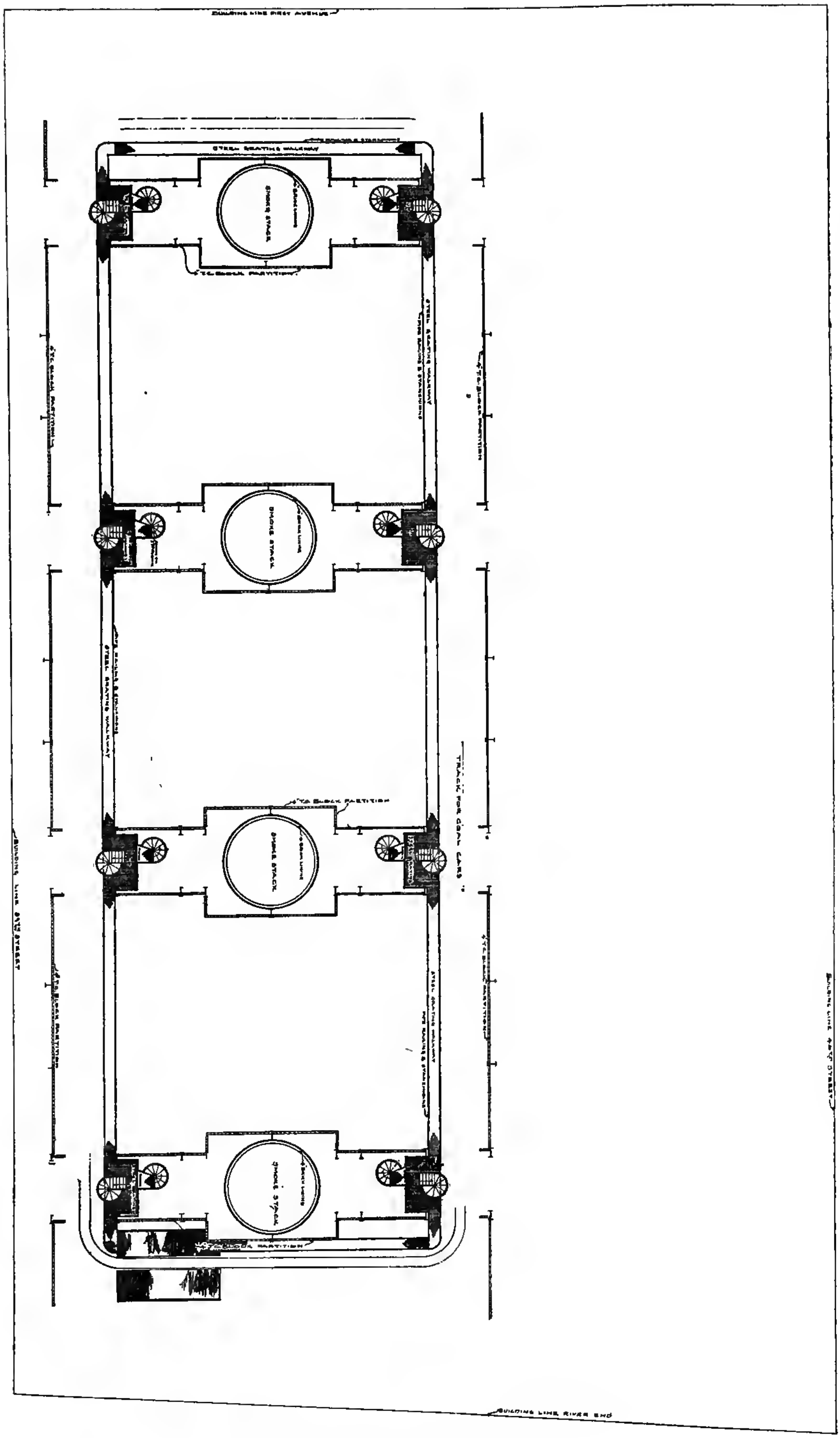


SECOND FLOOR PLAN AND SECOND MEZZANINE.

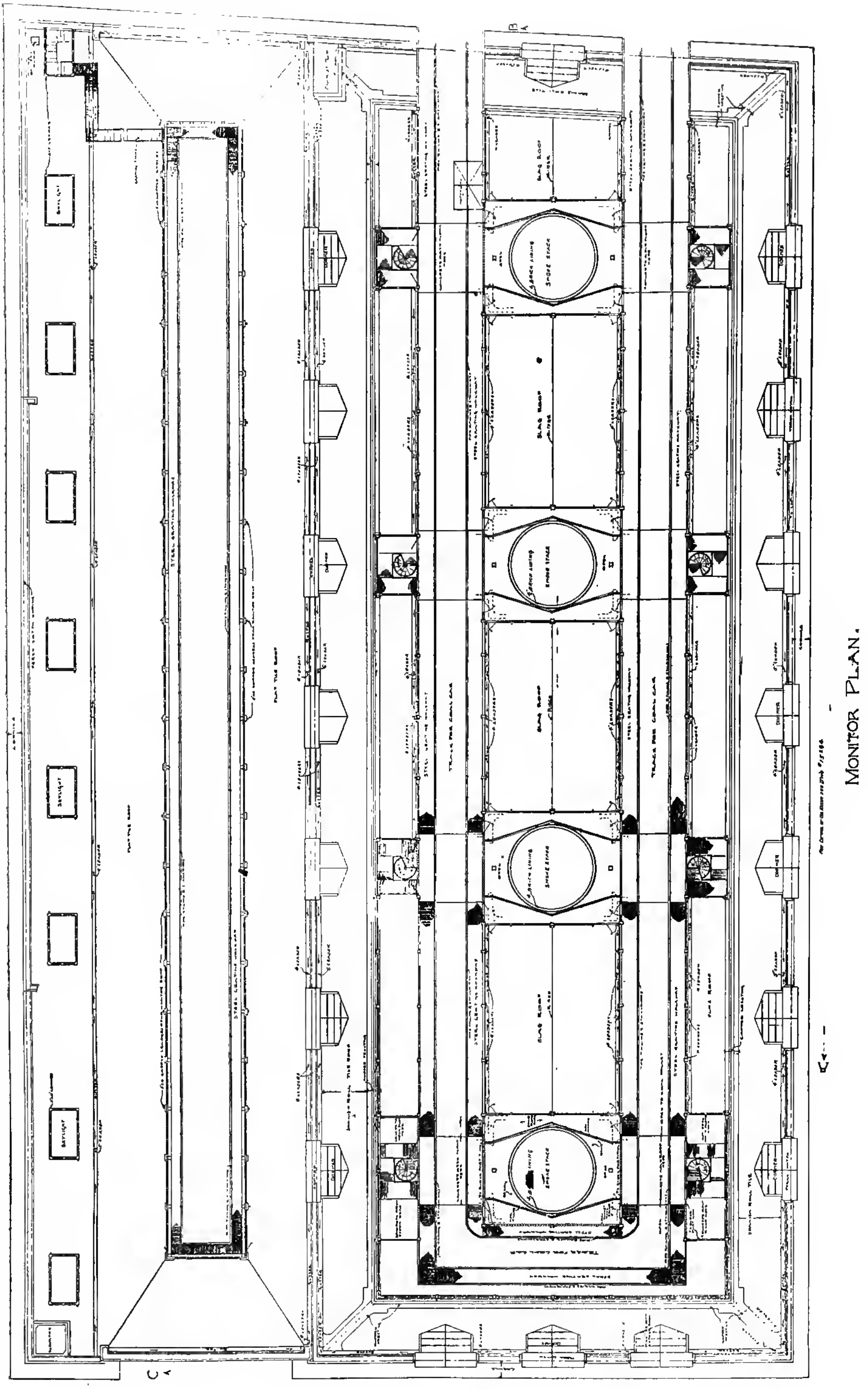


THIRD FLOOR PLAN AND FIFTH MEZZANINE.

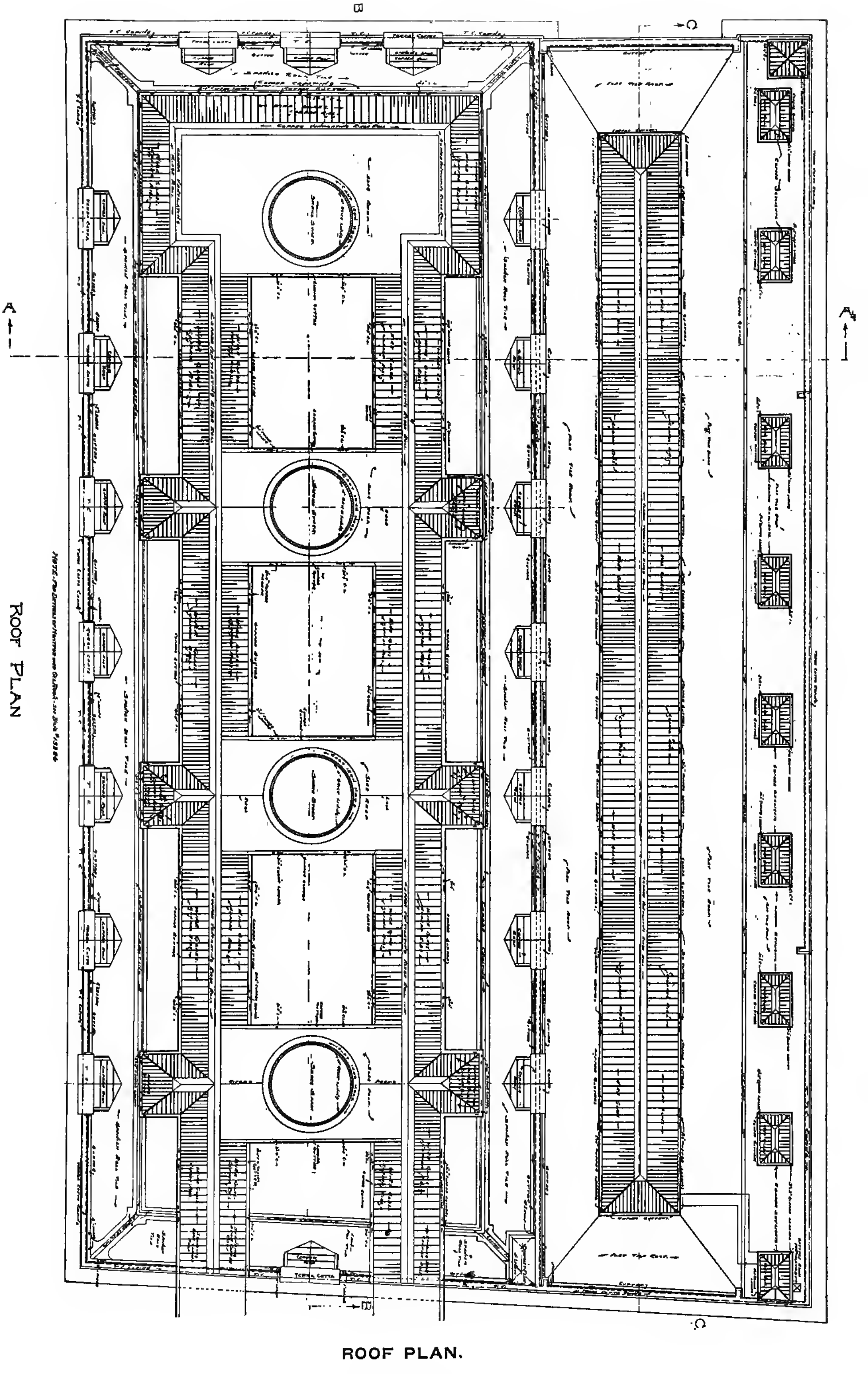
PLAN OF TOP OF COAL POCKET.
(SHOWING MEZZANINE WALKWAYS)



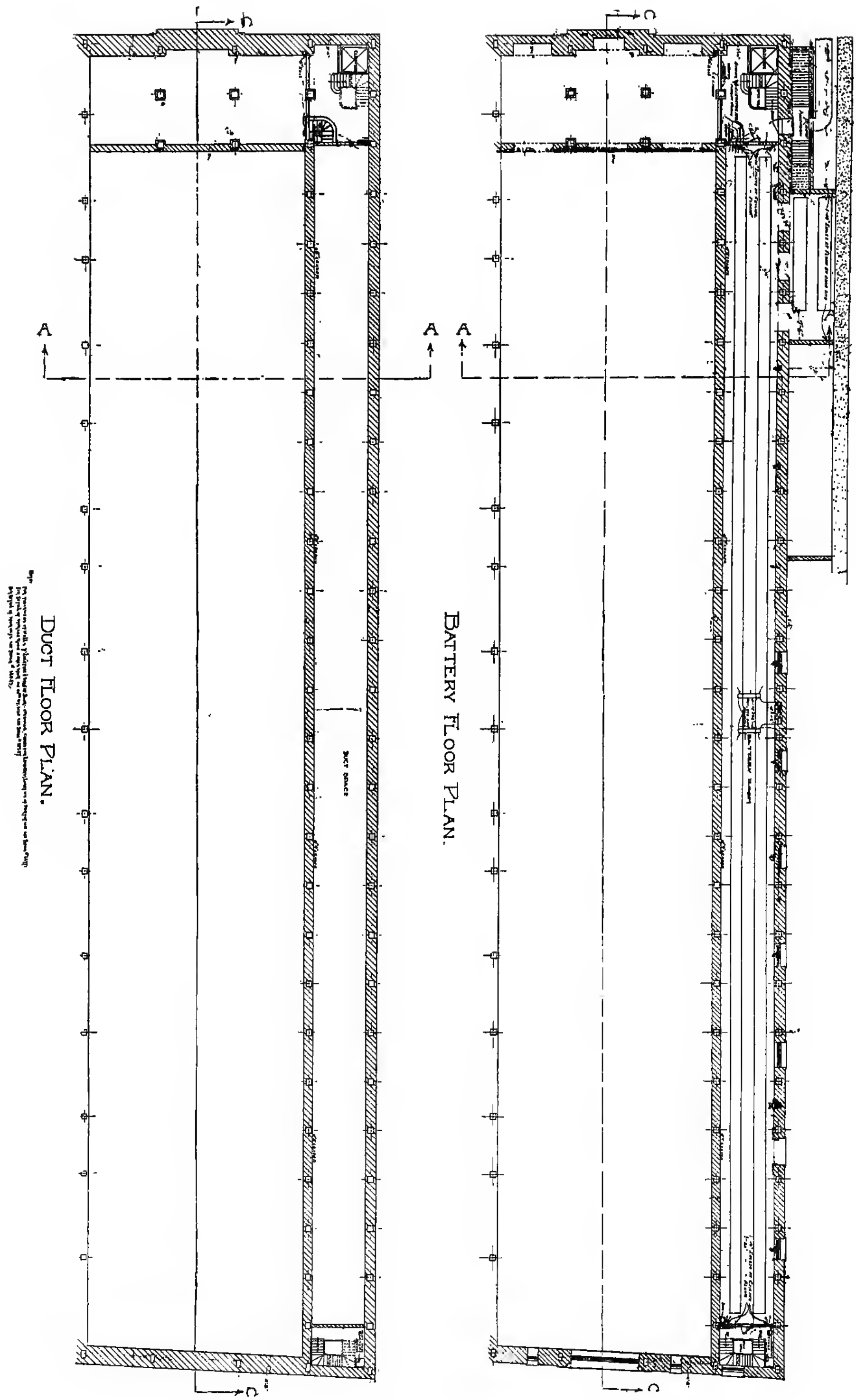
PLAN OF COAL POCKET.



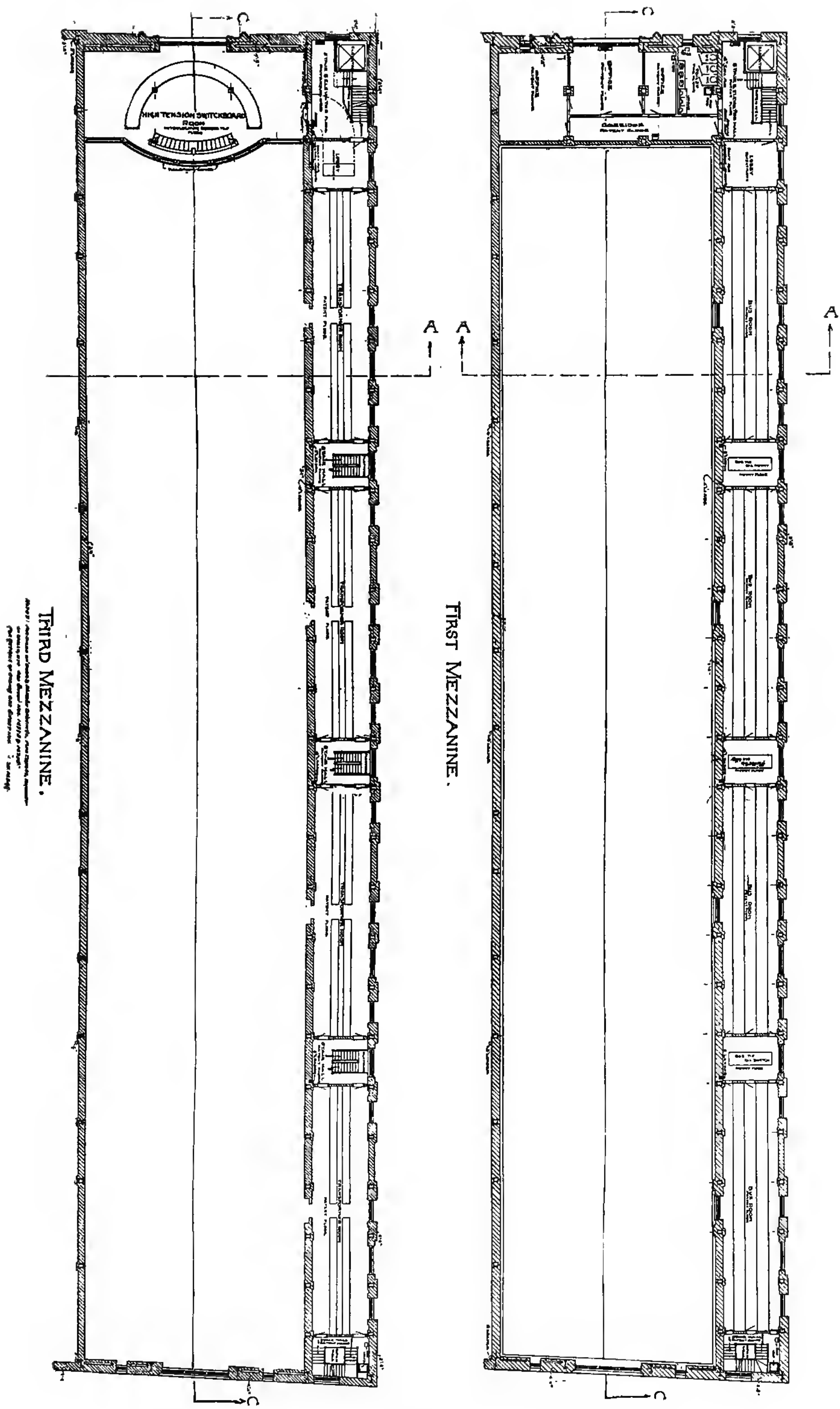
MONITOR PLAN.



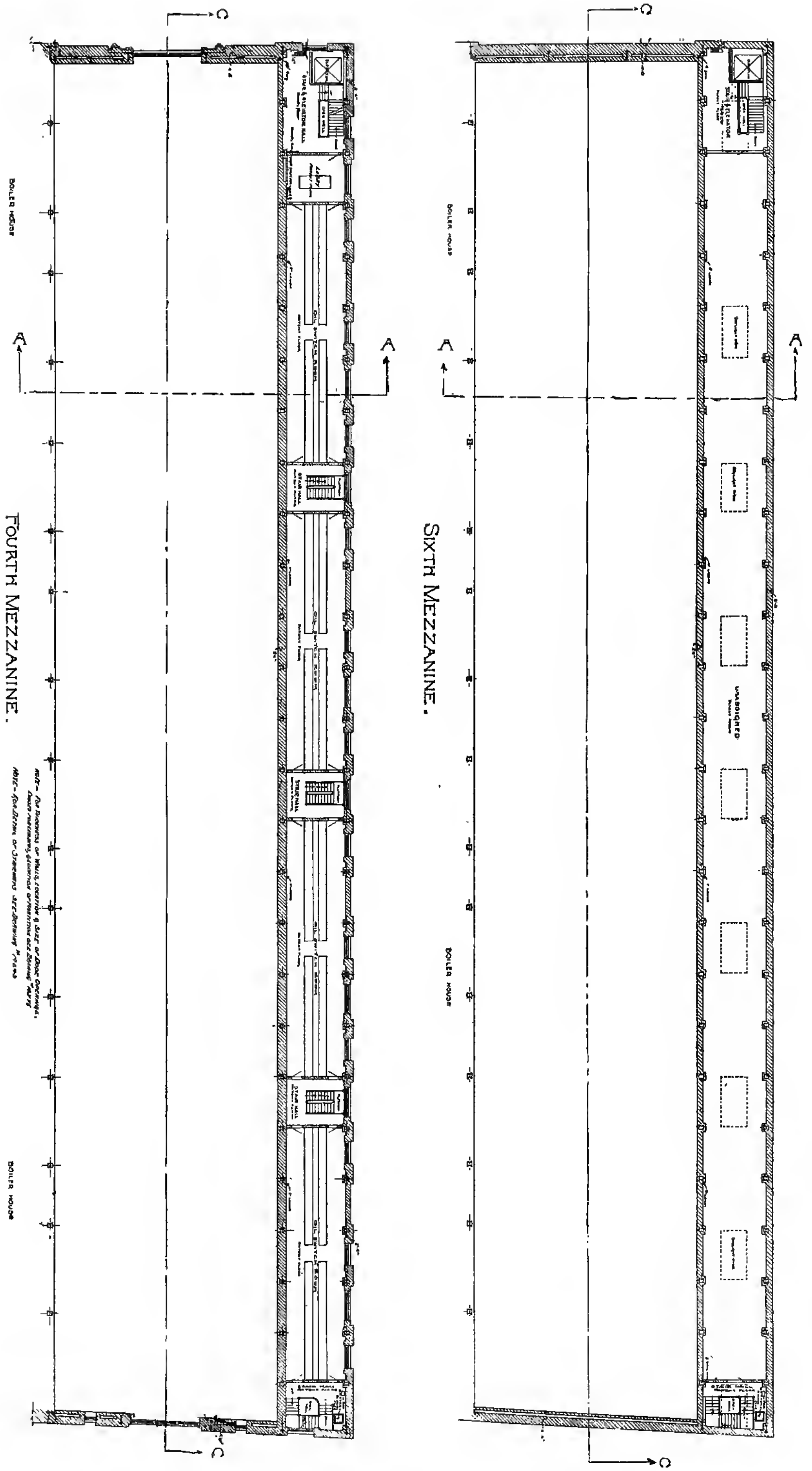
ROOF PLAN.



PLAN BATTERY ROOM AND DUCT FLOOR.



PLAN OF FIRST AND THIRD MEZZANINE.



PLAN OF FOURTH AND SIXTH MEZZANINE.

The ends of the condensation gutters shall be thoroughly connected with the lining of the gutter cornices so that there will be no open spaces other than the outlets required for the condensation gutters.

At the tops of all skylights provide moulded ridge ventilators, connecting same with the cap flashings.

34. ELEVATOR BULKHEAD:

The bulkhead over the elevator shaft in the northwest corner of the roof over the operating room shall be constructed with moulded copper gutter cornice set to a level line around bulkhead and provided with an inner lining of copper properly graded to the leader outlets.

The sides of bulkhead from the main roof up to the underside of the gutter cornice shall be of crimped copper secured to the structural framing and the masonry blocks.

The skylight over bulkhead to be constructed as hereinbefore specified.

35. DORMERS, LOUVRES, MANSARD CORNICE AND CRESTING:

The seven ventilating dormers along the northerly side of the mansard roof on a line with the division wall between the boiler house and operating room shall be constructed entirely of copper with pediments, cornices, pilasters, etc., similar in design to the dormers on the street fronts where marked to be of terra cotta.

The roofs of these dormers, including the roofs of all dormers where marked to be constructed of terra cotta, shall be of standing seam copper secured to the masonry roof blocks in a thorough manner.

The stationary louvres in all dormers shall be of copper frames with double thickness copper blades stiffened at edges with ½″ round steel rods.

The copper frames shall be secured to the 6″ steel channel frames around the openings.

The moulded and ornamented cornice and cresting along the four sides of the mansard roof over the boiler house, including the moulded hips at the four corners, shall be constructed of copper.

Provide stamped copper ornamented scroll brackets along the copper cornice and at each corner of the roof, as shown on drawings.

36. MONITORS AND BULKHEAD LEADERS:

The leaders from the gutter cornices of the monitors and elevator bulkhead to the main roofs shall be of crimped copper, 3" x 4" in size, secured to the sides of monitors and bulkhead by means of heavy copper bands and provided at the bottom of each leader with a bent shoe.

37. GEARING FOR MONITOR SASH:

The pivoted sash in the monitors shall be operated in sections of from four to eight sashes by means of 1" heavy galvanized wrought iron pipe shafting, durable cast-iron brackets, sash arms, hand wheels, worm gears, etc.; complete, and the gearings shall be secured to the structural steel framing and steel grating walkways in a thorough manner.

38. GLAZING:

The glazing for the skylights over the larger and smaller monitors and elevator bulkhead and the pivoted sash and sash doors in all monitors shall be of a first quality wire glass ⅜" in thickness, of uniform color and quality throughout, and shall be free from all imperfections.

The glazing shall be done in a manner hereinbefore described under "Monitors" and no putty will be allowed in any portion of the work.

39. ROOFING:

(1) *Roof Over Operating Room.*—The entire area of the roof over the operating room and the roof over the northerly electrical mezzanines shall be of felt and flat tile to be laid as described in the following:

The tops of the concrete roof arches will be prepared with a cement coating by the mason and the roofing contractor shall lay over this coating no less than four ply of No. 1 Vulcanite roofing felt, lapping each successive layer at least two-thirds of its width over the preceding layer, firmly securing the felt with tins or cleats in a manner customary in the best composition roofing, and thoroughly mopping the surface of each layer with a thin coat of "Trinidad Lake" asphalt, in no case to be applied hot enough to injure the wooly fibre of the felt. Over the entire surface of the felt thus applied, spread a good surface of roofing cement, amounting in all, including what is used between the layers of felt, to not less than 10 gallons of cement per 100 square feet, and heated as hereinbefore specified.

The felt shall be carried down into the main steel roof gutters, across the bottoms and up on the other sides of same, and up on the brick walls and monitors, in order to secure an unbroken surface of waterproofing over the entire area of the roof except at the monitors.

The felt shall be laid into the gutters after the cement filling has been done by the mason.

On top of the felt thus applied, including the sides and bottoms of the main roof gutters, the Contractor shall lay a 1" x 6" x 9" hard vitrified flat roofing tile well bedded in Portland cement, which shall be not less than ¾" in thickness, and after the tile are laid, all butt joints shall be cleaned off and the entire surfaces left smooth.

(2) *Flat Roof Over Boiler House, Etc.*—The tops of the concrete arches of the flat roof over the boiler house, including the flat roofs of the monitors at smoke stacks, will be prepared with a cement coating by the mason and the roofing contractor shall lay over this coating no less than four ply No. 1 Vul-

canite roofing felt which shall be laid as hereinbefore specified for the roof over the operating room.

Completely cover the felt with a coating of slag, using no slag larger than that which will pass through a 5/8" mesh and none smaller than that which will be caught by a 1/4" mesh screen; the slag shall be free from sand, dust and dirt, and shall be applied perfectly dry and while the cement is hot.

(3) *Mansard Roof Over Boiler House.*—The four sides of the mansard roof shall be of a hard burned vitrified glazed Spanish roll tile, to be selected by the Company. The tile shall be laid in straight level courses and shall be perfectly fitted around all dormers and roof hips.

Tile shall be secured in a thorough manner to the wood sleepers with copper nails.

All tile shall be of uniform color and size and shall be free from any checks, cracks or other imperfections.

40. Main Roof Gutters and Flashings:

All of the main roof gutters are to be constructed of steel and erected perfectly level from end to end of building by the steel contractor. The mason contractor will provide the cement filling in all gutters and properly grade the same to the leader outlets.

On the top of the cement filling the roofing contractor shall continue the four ply No. 1 Vulcanite roofing felt down into the gutters, across the bottoms, and up on the opposite sides of same. The gutters shall then be flashed on both sides with copper, laying same at least 6" under the tile and slag roofs, after which all of the gutters shall be lined with the vitrified roofing tile and thoroughly connected with the slag and tile roofs, and be well bedded in Portland cement with all of the butt joints cleaned off smooth.

The monitors, elevator bulkhead and dormers, and all walls, smoke stacks, vent stacks, soil and vent pipes and the roof gutters, etc., shall be flashed in a thorough manner with copper.

The flashings shall be laid at least 6″ under all tile and slag roof and shall be continued well up on all walls, pipes, etc.

41. Framing and Drilling of Structural Work:

All of the miscellaneous iron framing that may be required for the support and stiffening of the copper ventilators on the ridges of the skylights, or for any portion of the work shall be furnished by the sheet metal and roofing contractor, and any and all drilling of the structural steel work of the monitor or building construction that may be required in order to secure the sheet metal and roofing work shall also be done by the contractor.

42. General:

All of the copper work specified herein which includes the sides and ends of the monitors and bulkhead, dormers, louvres, sash, skylight condensation gutters and caps, ridge ventilators, mansard cornices and crestings, gutters, linings, ornamental stamped work, flashings, etc., shall be of 20-oz. copper.

All of the sheet metal and roofing work shall be constructed in the most substantial and approved manner and must be equal to the best known standards of construction applying to this class of work.

Full size details will be furnished by the company at a later date, and they must be closely followed in every particular.

ORNAMENTAL IRON.

Cast Iron and Wrought Iron Work:

43. Exterior Window-Frames and Sash:

All of the window frames and sash for the openings in the four exterior building walls shall be constructed of wrought iron.

The jambs, mullions and division bars shall be re-enforced on the sides with steel channels and tees, connected at the top and bottom to the I beam lintels and sills, and forming a framework to which the ornamental window construction is to be secured.

The casings around the channels, I beams and tees shall be of wrought iron with wrought iron mouldings, forming panels on the inside and outside faces of all mullions and division bars.

The mullions and jambs shall be provided with ornamental caps and moulded bases, and the girders and I beams at each floor level and other divisions wherever shown shall be encased on the inside and the outside of same, with wrought iron and cast iron moulded and panelled fascias 3/8" thick securely connected to the structural steel framing and shall be designed to conform to the details of the window construction.

The sash shall be constructed of wrought iron, to be pivoted at the top to swing outward, and shall be provided with horizontal, vertical and diagonal moulded muntins with small cast rosettes at intersections.

All sash shall be arranged to pivot and shall be operated in sections from the various floor levels by means of an approved gearing of neat and substantial design, and shall be so designed that the sashes can be opened and closed easily and without jar, and that when closed the sashes shall fit snug against jambs.

The gearing operating the sash in all openings in offices, entrance lobby and stair and elevator hall on main floor, and the offices and high tension switchboard room located on the westerly mezzanine floors shall be of bronze, and all other gearing shall be of wrought iron with a neat finish.

Suitable anchors shall be provided at frequent intervals on all window frames to be built in with masonry walls.

44. Exterior Doors and Transoms:

All doors and transoms in the openings in the four exterior building walls, wherever indicated on drawings, shall be constructed of wrought iron and steel.

The jambs and transom bars shall be constructed of 8″ channels, the transom bars to be formed of two channels set flange to flange and connected to jambs. The jambs shall be provided with wrought iron staff mouldings and moulded wrought iron jamb stops. The transom bars shall have wrought iron mouldings on both faces.

The doors for the first story openings shall be constructed of ¼″ steel plates separated by ½″ steel filler plates securely riveted together at all rails and stiles.

Panels shall be formed of wrought iron mouldings on both sides of door and fastened with countersunk tap screws.

The upper panels shall have separate hinged glazed sash, constructed of wrought iron frames and moulded muntins. with wrought iron moulded beads for fastening glass in frames.

The transoms shall be of similar construction as specified for doors and shall be constructed so as to be easily removed in sections.

The doors in openings in the 39th Street building wall at the level of the second boiler floor shall be of similar construction as hereinbefore specified, with the exception that the lower half of doors shall be glazed instead of being solid, so as to conform with the details of the window construction of which they are to form a part.

The channel jambs of doors shall be secured to the masonry with countersunk ¾″ expansion bolts. Doors shall be hung on durable semi-ornamental wrought iron strap hinges riveted to doors and jambs and shall be amply proportioned to sustain the weight of the steel doors.

Provide durable wrought iron slide bolts for the top and bottom of each door.

The entrance door on 40th Street at the level of the bottom of area steps shall be constructed of kalamein copper as hereinbefore specified.

The main entrance doors to vestibule on First Avenue shall be of bronze as hereinafter specified.

45. Engine Room Stairs:

The stairs in the northwest corner connecting the stair and elevator halls from the basement to the sixth mezzanine floor, inclusive, the stairs in the northeast corner from the basement to the roof, inclusive, and the three lines of stairs connecting the stair halls from the second mezzanine floor to the fourth mezzanine floor, inclusive, shall be constructed as per the following:

Exposed and wall strings shall be panelled and moulded of cast iron ⅜″ thick by 14″ wide, and provided with continuous cast lugs on same for supporting the marble and iron treads.

Newels shall be 5″ square with moulded caps and bases and sunk panels on all sides.

Balustrades shall consist of ½″ x 1″ wrought iron top and bottom bars under hand rails and top of strings, and ¾″ x 1″ vertical bars spaced about 6″ apart and provided with ornamental scrolls top and bottom.

Handrails and balustrades shall be provided for both sides of each stair of 2″ heavy bronze pipe, with circular cast bronze flanges at all newels.

The treads and platforms for the stairs in the northwest and northeast corners, from the basement floor level up to the level of the battery room mezzanine floor, shall be of checkered cast iron, with solid borders and moulded nosings and provided with an approved carborundum and steel (or equal) safety tread, fastened with countersunk tap screws.

The treads and platforms of all stairs above the level of the battery room mezzanine floor shall be of marble as hereinbefore specified under "Marble."

Risers shall be panelled of cast iron ⅜″ thick with raised panel mouldings.

The five stairways from the level of the proposed engine room floor up to the main floor shall be constructed of similar design to other stairs hereinbefore specified and the treads shall be of cast iron with moulded nosings and provided with an approved carborundum and steel (or equal) safety tread, fastened with countersunk tap screws.

The stairs in the northwest corner from the level of the main floor up to the first mezzanine floor and the five stairways from the level of the proposed engine room floor up to the main floor, shall be electroplated.

46. Boiler House Stairs:

The six lines of stairs from the basement to the third floor inclusive and the four stairs from the basement to the first floor shall be constructed of panelled cast iron strings, panelled and moulded cast iron newels and panelled risers.

Hand rails and balustrades shall be constructed of 1½″ galvanized wrought iron pipe, connected to newels with standard pipe flanges, and the balustrades shall be screwed into threaded cast iron sockets secured to the outside of strings.

Balustrades shall be provided on both sides of stairs and shall consist of 1½″ galvanized wrought iron pipe uprights spaced about 24″ on centers.

Stair treads shall be of cast iron, checkered, with solid borders and moulded nosings and provided with carborundum and steel (or equal) safety treads, secured with countersunk tap screws.

Continuous lugs shall be cast on strings for the support of treads and risers.

47. Spiral Stairs:

The eight lines of stairs from the third floor to the mezzanine walkways and the eight lines of stairs from the mezzanine walkways up to the walkways in monitors shall be con-

structed of wrought iron plate strings with wrought iron mouldings and angles riveted in strings to support treads.

The central column supports shall be of extra heavy galvanized wrought iron pipe 5″ in diameter, securely imbedded in the cement filling over floor arches and fastened to the steel grating walkways and finished at top with cast iron turned terminals.

Treads shall be of cast iron with raised flanges at back and moulded nosing at front and provided with carborundum and steel (or equal) safety tread, secured with countersunk tap screws.

Balustrades and handrails shall be of 1½″ galvanized wrought iron pipe of similar design as hereinbefore specified for other stairs in boiler house.

48. ELEVATOR ENCLOSURE, ENGINE ROOM:

The enclosure around elevator shaft in northwest corner of operating room from the basement to roof shall be constructed of cast iron and wrought iron.

The main pilasters shall be of cast iron provided with moulded sunk and ornamental panes and moulded caps and bases.

The cast iron cornices around enclosures over pilasters at each ceiling level shall be enriched with egg and dart and dentils and beaded members, and shall have bed moulds which shall be continuous around the ornamental curved corbels over the ornamental caps over pilasters.

The doors shall be constructed of heavy wrought iron channels and wrought iron bars securely riveted together and rigidly braced.

The tracks and saddle curbs under doors and around enclosure shall be grooved and checkered of cast iron ⅝″ thick bracketed out and connected to floor beams.

The grille work shall be constructed of wrought iron bars of special design formed of ¼″ x ⅝″ to ½″ x 1″ bars, provided with scrolls and wrought iron ornamental leaf drops and turned separator buttons.

The grille work shall be provided from floor to ceiling, and including the doors, and shall be divided by horizontal transom division bars at heads of doors, provided with moulded and ornamental sunk panels of similar design as specified for pilasters.

The grille work for basement shall be of wrought iron bars of similar design to that hereinbefore specified.

All of the exposed structural steel floor beams at each floor on the inside of shaft, from the level of each floor down to the bottom of the cornice around enclosure of floor below shall be covered with No. 19 gauge crimped sheet iron plates.

The doors shall slide on "Reliance" hangers and the portion of enclosure at sides of doors shall be hinged to swing out in order that an opening the full width of shaft can be obtained.

Doors shall be provided with substantial approved elevator door locks and keys.

The entire ornamental enclosure on the main floor shall be electroplated.

49. Elevator Enclosures. Boiler House:

The enclosures around elevator shafts in the northwest and northeast corners of boiler house from the basement to the third floor, inclusive, shall be constructed of cast iron and wrought iron and wire grille work.

The lower portion of enclosures, including the doors for a height of three feet above floor, shall be a solid wainscoting of cast iron, panelled with raised mouldings, and provided with moulded cappings and moulded bases.

Provide moulded cast iron cornices around enclosures at top of doors.

Pilasters shall be of cast iron with plain sunk panels and moulded bases and caps.

The grille work for enclosures between the wainscoting and the cornices over doors, and including doors, shall be formed of wrought iron bars 1/8" x 5/8" to 3/8" x 1" of simple design with wrought iron bar rings top and bottom.

The pilasters and division bars for the upper portion of enclosures shall be constructed of steel channels of same width as pilasters below, and the grille work above cornices shall consist of No. 10 wire interwoven in diamond pattern and of ¾″ mesh; frames for wire grilles shall be of wrought iron securely connected to pilasters and division bars.

The doors shall be constructed of heavy wrought iron channels and wrought iron bars securely riveted together and rigidly braced.

Provide checkered and grooved cast iron saddles under doors ⅝″ thick, bracketed out and connected to floor beams.

The doors shall slide on "Reliance" hangers and the portions of enclosures at sides of doors shall be hinged to swing out in order that an opening the full width of shaft can be obtained.

Doors shall be provided with substantial approved elevator door locks and keys.

50. Fascias and Railings:

The fascias covering the structural floor framing at the front of the high tension switchboard floor at the third mezzanine floor level, also in front of the mezzanine at the battery room level in the northwest corner of operating room, shall be moulded and panelled of cast iron ⅜″ thick.

The floor curb plate over fascias shall be ¾″ thick, moulded and ribbed, and shall project above the finished floors, forming a continuous base plate under the railings for the attachment of same, moulded and panelled soffits shall be provided under fascias and shall cover the bottom flanges of framing beams.

Substantial lugs and ribs shall be cast on the backs of fascias at frequent intervals and shall be accurately fitted to the structural framing beams to which they shall be securely connected.

Lugs shall also be cast on the underside of the floor curb plates at every stanchion of the railing and ⅞″ diameter holes shall be provided in lugs for inserting the stanchions.

The railing along mezzanine at battery floor level in the northwest corner of operating room shall be constructed of solid polished steel stanchions spaced about four feet apart, and they shall be 1½" in diameter, and shall be furnished with turned steel base flanges 2½" in diameter and 2" high, and shall have ⅞" diameter holes drilled in same, the lower portions of stanchions where reduced to ¾" in diameter shall be inserted through the base flanges and the lugs of floor curb plates and shall be threaded for nuts.

The upper parts of stanchions shall be threaded to receive hollow cast composition bronze balls 2½" in diameter.

The handrails shall be of 1½" diameter polished bronze pipe.

The grille work filling between stanchions shall be constructed of wrought iron bars with ornamental scrolls.

Provide for the fronts of the two wind-brace walkways at the easterly end of the operating room cast iron moulded and panelled plates both sides of structural framing, forming the railings for walkways. The ornamental curved brackets under the wind-brace walkways and under the swell front fascia at the third mezzanine floor level shall be of cast iron.

Cast iron fascias shall also be provided to cover all of the structural floor framing around the insides of all stair well openings at each floor for both the engine room and boiler house. Fascias shall be provided with top floor curb plates and panelled soffits, and shall be constructed in a similar manner in every way to the fascia work hereinbefore specified.

51. Sidewalk Vault Lights:

The sidewalk vault lights shall be the "Mackay" or equivalent, constructed of cast iron frames, with cast ribs and rectangular prismatic glasses set in Portland cement and provided between the glasses with lead or carborundum. Frames shall set flush with finished sidewalks and shall be securely connected to the structural steel sidewalk beams and to the 3" x 3" angles on walls, which are to be fastened to walls with ⅝" expansion bolts.

Vault light frames shall be designed to safely sustain a load of 300 lbs. per square foot.

52. Window Guards:

Provide wrought iron window guards to all exterior window openings in basement below first story sill course.

Guards shall be constructed of 1" x 1" wrought iron bars 5" on centres both ways and shall be woven in basket pattern.

Holes shall be drilled into the granite jambs for the window guards and connections shall be leaded.

53. Folding Gates:

Provide folding gates of the "Pitt" patent for the eleven door openings in the exterior walls for the first and second floors of the boiler house.

Gates shall be seven feet in height, constructed of steel channels riveted at connections and provided with ornamental scrolls at top.

Provide durable padlocks and keys for all gates.

Holes shall be drilled into the brick and granite door jambs and all connections shall be leaded.

54. Walkways, Ladders and Railings:

All walkways, grating, floors, etc., shown on the drawings and unless otherwise specified, and also the stair and walkway leading from stair bulkhead to engine room monitor on roof shall be constructed of ¼" x 1½" steel bars spaced 1½" on centers and riveted into cross bars ⅜" x 1¾"; all I beam or channel framing required to support the gratings and all connections and drilling that may be required shall be provided by the Contractor.

All ladders over boilers where shown on drawings shall be durably constructed of heavy wrought iron bars with round wrought iron rungs spaced 12" apart; all brackets, connections, angles, etc., required as a part of the ladder construction shall be furnished.

Railings for all walkways and for all openings in floors, exclusive of the railings hereinbefore specified for stairs and mezzanine floors, shall be constructed of 1½″ galvanized wrought iron pipe, with heavy cast iron pipe flange connections, and secured either to the tops of walkways or to the sides of framings supporting walkways, as will be directed by the Company. Railings around openings in floors shall be secured to the curb angles hereinafter specified. All of the work and materials shall be equal to the best standards of construction applying to this class of work.

55. Door Sills:

Sills for all door openings throughout the building, exclusive of the sills hereinbefore specified in Clause No. 33, shall be ¾″ thick of cast iron, checkered with solid border and provided with mouldings each side.

Sills shall be the full width of jambs as indicated on drawings and shall be securely fastened to floors.

The sills for openings in division wall between boiler house and operating room where double doors are to be provided shall be the full width of the wall, and set in the brick jambs 2″ and extend 3½″ beyond the face of wall, both sides, and set 1½″ above finished floor, sills shall be constructed in accordance with the specifications of the New York Board of Fire Underwriters.

56. Trench Cover Plates:

Provide cast iron cover plates for all basement drain trenches 1″ in thickness, provided with perforations and checker work, with solid margins along the edges.

Plates shall rest on angle curbs which shall be provided along both sides of trenches.

Plates shall be laid in such a manner that there shall be no open cracks and so that each will be perfectly level and have a solid bearing, making the rocking of the plates impossible.

57. Partition Buck Stays:

Provide 5″ I beams and channels spaced about four feet on centers for all partitions enclosing the offices and toilet room on the mezzanines at the westerly end of operating room, and for all tile partitions on walls enclosing coal pockets and the partitions in monitor walkways in boiler house wherever indicated.

Frame around all window and door openings.

Framing shall be securely connected to the structural floor framing.

58. Curb Angles:

Provide curb angles for the front of the third mezzanine and for the front of the stair and elevator hall at battery floor level in the northwest corner of the operating room where cast iron fascias shall be provided. Also provide curb angles for all stair wells and other openings in floor wherever shown in drawings.

Provide 3″ x 3″ angles secured to the tops of roof purlins along both sides of all main roof gutters.

Curb angles shall be 4″ x 6″ and shall be securely bolted to the structural steel floor framing beams.

59. Framing for Copper Partitions:

Provide the I beam, channel and tee iron framing for the kalamein copper partition located in the front of the third mezzanine at the westerly end of the operating room, and for the timekeeper's booth located in the stair hall on the battery room floor level at the northwest corner of the operating room.

Framing shall consist of 10″ I beam uprights at each pilaster, 10″ channel along the top at cornice, 8″ channel at top of wainscoting between I beam uprights and 4″ tees and channels framed around each window.

All framing shall be securely connected to structural framing.

60. Framing for Terra Cotta Cornice and Dormers:

The framing for the support of the main terra cotta cornice around the four walls of the building shall consist of channels, angles, tees and I beams as shown on detail drawing.

The framing for the roofs of dormers on the mansard roof of the boiler house shall consist of 3" x 3" tees, spaced 25" on centers and connected to 8" channels, which are also to be provided at sides of dormers.

Provide 8" channel frames around openings when louvres shall be provided for all dormers.

61. Framing for Faience Cornice:

The framing of the faience cornice around the four walls of the operating room at the level of the underside of the crane girders shall consist of 2½" x 2½" angle and tee brackets spaced about 16" on centers and secured to the brick walls and structural steel building columns in a thorough manner.

62. Framing for Skylights and Pent Houses:

The framing for skylight and elevator and stair pent houses on the roof over the northerly electrical mezzanines shall consist of 6" I beam uprights and 6" channels at cornices and 4" channels framed around all window and door openings.

The framing for skylights shall consist of 3" x 3" tees connected to 3" x 3" tees at ridge and to channels at cornices.

63. Anchors:

The Contractor shall provide galvanized wrought iron anchors that may be necessary and required to anchor all building walls to the structural steel work and also for granite and terra cotta work throughout.

64. Lockers:

Provide and erect the entire equipment of lockers where shown on drawings. Lockers shall be constructed of durable angle iron frames and expanded metal, and shall be set up on legs. The doors shall be hinged and fitted with suitable locks and duplicate keys. Lockers shall be 15″ x 15″ in size and about 7 feet in height and shall be provided with expanded metal shelves and suitable clothes hooks.

Bronze Work.

65. Entrance Doors and Transom:

The main entrance doors, door frame and transom on First Avenue shall be constructed of bronze.

The doors shall be 2″ thick with solid panels with raised ornamental panel mouldings and rosettes.

The transom shall be 1½″ thick and shall be made to pivot at sides.

Door frames shall be 2″ thick and 10″ wide, rabbeted and moulded and panelled.

66. Window Frames and Sash:

The window frames and sash in the walls between the entrance vestibule and entrance lobby, the entrance vestibule and office, and in the wall between the operating room and the northerly electrical mezzanines shall be constructed of bronze.

The sash shall be 1½″ thick provided with diagonal moulded muntins as shown.

The frames shall be 2″ thick by 6″ wide and moulded.

The sash shall be made stationary.

67. Pilaster and Column Caps:

The caps to all columns, pilasters and piers in the entrance lobby, entrance vestibule and the stair and elevator hall on the main floor at the westerly end of operating room shall be of

bronze, and shall be ornamented with egg and dart mouldings, dentils and beaded members and ornamental cartouches, etc., of special design.

68. Tablet:

Provide a bronze tablet to be placed on wall in entrance vestibule, 30″ wide by 36″ high with moulded and ornamented border of egg and dart moulds and leaf work.

Tablet shall contain the names of the station and the company and the names of the offices of the company in raised roman letters.

69. Panel Box:

Provide an electric light switch panel box frame of bronze, of similar design as hereinbefore specified for ornamental border around tablet.

Panel box frame shall be about 2′ 6″ by 4′ 0″ and shall be provided with a hinged door with a solid raised panel and ornamental raised panel mouldings and shall be provided with a bronze snap catch of neat design.

Panel box shall be located in the stair and elevator hall on the main floor.

70. Area Railing:

The railing on coping wall of area on 40th Street shall be constructed of bronze.

The posts shall be 6″ x 6″ tapered with curved tops and shall be panelled and fluted on front faces.

Posts shall be provided with wide base flanges and shall be secured to the granite coping with ¾″ countersunk expansion bolts and the heads of bolts shall be tapped to receive bronze button heads.

The railings shall be of heavy bronze pipe 3″ in diameter and provided with neat turned flanges of bronze at posts.

71. General:

Steel is to be good quality in accordance with the Standard Specifications of the American Association of Steel Manufacturers.

Cast iron is to be tough grey iron, true to pattern, and of workmanlike finish, free from blow holes, cold shuts, or other defects. All members composing the various parts of the work shall be accurately laid out and fitted together with the best attainable degree of precision, and the parts must be so finished that when joined together there will be no open joints or other defects.

All plates, channels, angles, etc., where shown straight must be absolutely straight, and where bent, must be bent accurately to radius, being free from all twists and kinks. Rivets when driven, must completely fill the holes, have full hemi-spherical heads concentric with holes and in full contact with surfaces. All wrought iron mouldings where specified are to be those manufactured by the J. G. Braun Company, and they must be accurately fitted together.

All drilling of the structural steel work that may be necessary or required in order to erect any and all portions of the ornamental iron work shall be done by the Contractor and shall be included in his contract.

All work shall be executed in accordance with scale and full size details to be furnished by the Company later.

GLAZING.

72. Glazing:

All of the windows and the entrance door transom opening into the operating room, offices, high tension switchboard room, toilet room, and the entrance vestibule, entrance lobby and the stair and elevator halls on all mezzanines shall be glazed with a first quality polished plate wire glass 3/8″ thick.

All other windows and doors in the four exterior walls shall be glazed with a first quality wire glass 3/8″ thick of uniform color and texture throughout.

All interior sash and glazed panel doors, including the ceiling over the high tension switchboard room and the sides and ceiling of the timekeeper's booth, shall be glazed with a first quality polished plate wire glass 3/8" thick.

PAINTING.

73. PAINTING:

The Contractor shall provide the painting of all of the portions of the building described in the following:

(1) All of the exposed structural steel work of the entire structure, which includes the columns, girders, beams, roof trusses, and crane girders, etc.

(2) All of the ornamental iron work, which includes the stairways, fascias, railings, elevator enclosures, window frames and sash, doors and door frames, sidewalk lights, walkways, gratings, window guards, foldings gates, etc., etc.

(3) All of the plastered walls and ceilings of all rooms.

(4) All exposed plumbing and drainage pipes.

(5) All kalamein iron doors and trim, including the tin covered wood doors.

(6) The underside of the plastered roof arches over the operating room.

All of the above mentioned work shall receive three coats of the best white lead and pure linseed oil in colors to be selected by the Company.

The following is a list of surfaces to be painted two coats of an approved cold water paint.

(1) All of the exposed surfaces of the ceilings of the first, second and third floors of the boiler house.

(2) The walls, partitions and ceilings of the basement of both the operating room and boiler house.

(3) The surfaces of the concrete turbine foundations.

(4) The outside surfaces of the concrete walls and tile partitions enclosing coal pockets in the boiler house.

All surfaces of work to be painted shall be thoroughly cleaned of iron rust scale, dust, cinders, or other materials deposited during the erection of the building before paint is applied.

All iron work shall receive one good coat of graphite or red lead and linseed oil before being delivered at the building.

The oak doors to water-closet apartments in toilet rooms and the oak doors to battery rooms shall receive two coats of spar finished varnish and one coat of wood filler.

PLUMBING.

74. Fixtures:

Toilet Room, First Mezzanine Floor.

(1) *Water-Closets.*—To be the Improved "Hygeno-Sano" syphon closet of one piece white vitreous porcelain, with recessed flushing rim at back and recessed porcelain hump in front, and provided with low-down cabinet finished oak cistern, and cabinet finished oak seat. Cistern to be lined throughout with 20-oz. copper and furnished with nickel-plated push button flushing release and removable cover. Cisterns shall be provided with all necessary valves and shall be connected with 1½" nickel-plated flush pipe. Closets shall be provided with the sanitary perfect screw connection.

(2) *Urinals.*—To be the "Metropolitan" one piece porcelain urinal, with brass trap, and provided with the "Presto Simplex" push button flush valve. Cisterns shall be cabinet finished oak cisterns, 12" x 12" x 20" in size and completely lined with 20-oz. copper, and provided with valves and nickel-plated chains complete. Each urinal shall have separate cistern.

(3) *Lavatories.*—To be the "Tremont" imperial one piece porcelain lavatory 24" x 22" with nickel-plated "Metropolitan"

waste with china handles, imperial porcelain standard and nickel-plated brass wall supports; faucets for hot and cold water shall be nickel-plated low-down compression faucets, with china name-plates, and four ball handles; provide cast brass nickel-plated adjustable traps to walls.

(4) *Slop Sink.*—To be of improved type of one piece vitreous porcelain, provided with overflow, air chambers, and iron traps, and nickel-plated long nozzle draw-cocks, supplied with hot and cold water, and provided with nickel-plated waste and overflow strainers; slop sinks shall be 12″ x 20″ x 16″ in size.

Toilet Rooms, Vaults Under Sidewalks.

(1) *Water-Closet.*—To be the extra heavy improved "Torrento" syphon wash down closet of one piece white vitreous porcelain with direct-acting jet and sanitary recessed flushing rim, provided with low-down cabinet finished oak seat with nickel-plated ball post hinges. Cistern shall be lined throughout with 20-oz. copper and furnished with nickel-plated push button flushing release and removable cover. Cisterns shall be provided with the necessary valves and shall be constructed with 1½″ nickel-plated flush pipe.

Closets shall be provided with the sanitary perfect screw connection.

(2) *Urinals.*—To be the same as hereinbefore specified for the toilet room on the first mezzanine floor.

(3) *Lavatories.*—To be the "Norwalk" heavy imperial one piece vitreous porcelain lavatories, Class B, with integral backs, and provided with nickel-plated brass waste, plugs and stoppers, galvanized iron supporting frame with porcelain enameled iron leg, nickel-plated combination compression faucets with china name plates and nickel-plated soap dishes.

(4) *Slop Sinks.*—To be the same as hereinbefore specified for the toilet room on the first mezzanine floor.

(5) *Showers.*—To be "Mott's" nickel-plated brass rim shower, with 5″ slotted removable face, ½″ supplies, ½″ mixing column with adjustable ball joint and the "Bryon" nickel-plated all metal anti-scalding lever handle valve.

(6) *Acid Sink and Lime Box.*—The sink shall be 18″ x 24″ x 16″ deep of glazed earthenware and provided with heavy brass compression cock, and cast lead strainer.

The lime box shall be 20″ x 24″ x 16″ deep of glazed earthenware and shall be provided with outlets with lead connections burned out.

All fixtures shall be supplied with stop valves having detachable handles.

Under all water-closets, install "Motts" imperial porcelain floor slab.

The marble partitions shall be supported by nickel-plated bottom legs with deep slot to receive marble and having two bolts in each. Back supports shall be 6″ flanges with slot as described, and 3″ flat dowel at back, set into wall and attached with expansion bolts. All fittings shall be nickel-plated.

All fixtures herein specified are of the manufacture of the J. L. Mott Iron Works but the Contractor may, on the written approval of the Company, substitute the goods of other manuturers of equal quality and design.

75. House Sewer, House Drain, and Fresh Air Inlet.

The house sewer, running house trap and house drain shall be of extra heavy cast iron pipe, well caulked with picked oakum and lead.

The house trap shall be provided with hand holes for cleaning out same and shall be furnished with fittings for fresh air branches for the connection of heavy galvanized automatic ventilating fixtures approved by the Department of Buildings, and from which shall be run a 8″ galvanized wrought iron fresh air pipe leading to the bulkhead and protected with wrought iron gratings set in the bulkhead wherever directed. The connection of fresh air line shall be made on the house side of house trap.

House sewer, house trap and house drain shall be of sizes as marked on drawings.

76. Soil, Waste and Vent Lines.

All soil, waste and vent lines shall be of extra heavy galvanized wrought iron pipe and fittings with screw joints.

All fittings shall be of the drainage pattern, with shoulder on the inside and all pipe shall be screwed down hard against same to form a clear passage and shall be thoroughly gas and water tight.

Main soil pipes shall be 4″ in diameter and the main vents shall be 3″ in diameter.

The water-closets shall be connected to 4″ branch soil pipes; the urinals, wash basins and slop sinks shall be connected to 2″ branch wastes with 2″ traps, and the showers and floor drains shall be connected to 3″ branch wastes with 3″ traps.

The water-closets shall be connected to 2″ branch vents and the urinals, slop sinks and wash basins shall be connected to 1½″ and 2″ branch vents.

The acid sink in battery room shall waste through 3″ lead lined with 3″ lead-lined trap, into the lime box located on the duct floor directly underneath the sink, and the waste from the lime box shall be of 3″ lead lined pipe with 3″ lead lined trap and shall be connected to the house sewer on the sewer side of the house trap.

All branch waste and vent lines, exclusive of the waste lines from the acid sink and lime box, shall be of galvanized wrought iron pipe of standard weight.

The main vent lines shall be connected to the main soil lines above the highest fixtures and shall be carried up, through and above the roof of their full diameters, and shall terminate at least 5 feet above roof levels, and where these pipes pass through the roofs they shall be thoroughly flashed with 20-oz. copper caulked into the hubs of the pipes.

All horizontal lines shall have a pitch of at least ⅜" per foot, and the vertical lines shall be perfectly plumb and true and secured to the walls with heavy wrought iron staples and holdfasts.

All connections and bends shall be made with Y branches and one-eighth bends.

Clean-outs shall be located in convenient positions as directed and shall be provided with brass screw-covers.

All horizontal pipes above ground shall be supported by heavy wrought iron hangers or pipe rests.

77. Battery Room Floor Drain:

The battery room floor shall be drained through a special perforated cast lead plate 12" x 12" x 1" into a 12" x 12" x 6" deep lead box imbedded in the floor, and the lead box shall be drained through a 3" pure lead pipe with running trap and shall be connected to lead drain from lime box as shown on drawings.

All lead work shall be burned and no solder shall be used in any part of the battery room drains.

78. Floor Drains:

The floors of all toilet rooms and locker rooms shall be drained through 3" pipe as hereinbefore specified.

Provide suitable cast iron drain boxes imbedded in the floor, and provided with suitable perforated cast iron strainers over same.

79. Roof Drains:

The roofs shall be drained through galvanized wrought iron pipe of standard weight and of such sizes as marked on drawings, and shall be provided with traps and shall be drained into the concrete discharge tunnel.

The roof drains shall be connected and located where shown on drawings and shall be built into recesses in the brick walls.

The connection of leaders with roof gutters shall be made gas and water tight by means of heavy copper and lead drawn tubing, soldered to brass ferrules caulked into the pipes, and the tubing shall be suitably imbedded in the cement and thoroughly flashed with 20-oz. copper.

All pipe, pipe connections, pipe hangers and supports shall be the same as hereinbefore specified under clause No. 93.

80. Supply Pipes:

All fixtures shall be supplied with cold water and the wash basins, slop sinks and showers shall be supplied with hot water.

The street main shall be tapped for a 2″ pipe to supply all fixtures; the risers shall be of 1″ pipe, and the fixtures shall be supplied through ⅝″ and ¾″ pipe.

The hot water supply is to come from the hot water tank which will be located in the tank room in the basement of the boiler house.

The tank and the supply to same is not to be provided, but the connections and valves, and the supply piping from the tank to the fixtures shall be furnished.

All supply pipe for hot and cold water shall be of extra heavy galvanized wrought iron pipe with joints put together with red lead and tested with a pressure pump.

All piping shall be nickel-plated brass pipe where exposed around toilet fixtures and shall be run plumb and true and shall be put together with brass unions.

All pipe shall have gate valves, cut out and emptying cocks conveniently located, and shall have proper air vessels so graded that they may be emptied into the drain trenches in basement, and be provided with cocks for that purpose.

All pipes shall be fastened with split brass hangers and secured with approved pipe hangers wherever required.

The Contractor shall furnish and set up one 2″ water meter of an approved type and shall be acceptable to the Company.

All piping shall be erected in such manner so that same can be protected with felt or other approved covering if desired.

81. Stand Pipes and Fittings:

There shall be four 4″ galvanized wrought iron stand pipes provided for the building, one in the northwest corner of the operating room at stairs, one in the northwest corner of the boiler house at elevator, one at the southeast corner of the boiler house at stairs, and one at the south side of the boiler house about 100 feet east of the First Avenue building wall.

The stand pipes for the boiler house shall be provided from the basement to the third floor, inclusive, and the stand pipe for the operating room shall be provided from the basement to the roof, inclusive.

Stand pipes shall be provided with two-way "Siamese" steamer connections to be placed on the sidewalks and bulkhead above the curb level.

Provide 2½″ valves and check valves for each pipe, and nickel-plated hose reels and swing brackets together with 75 feet of the best quality of approved linen hose for each line of pipe at every floor and roof.

Stand pipes and fittings shall be of sizes, patterns and regulation kinds required by the Fire Department.

82. Tests:

The entire plumbing system shall be tested by a water test, before the fixtures are connected and after the work is completed, it shall be tested by additional peppermint and smoke tests.

All tests shall be made in the presence of an inspector of the Department of Buildings and shall be in accordance with the building laws.

83. General:

All fixtures shall be the best of their respective kinds and all work shall be done in a thorough and workmanlike manner to the entire satisfaction of the company, and all work shall be in accordance with the rules and regulations of the Bureau of Buildings for the Borough of Manhattan.

All of the plumbing work shall be furnished complete, with all such fittings and other appliances as will reasonably be included in work of this character, whether same is specified or shown on plans or otherwise.

The plumbing contractor shall procure all necessary permits in connection with his work and pay all fees for same.

BATTERY ROOM.

84. Battery Room:

The Contractor is to fill in over the floor arches with stone and Portland cement concrete of a mixture 1, 3, and 5, leveling same over beams and smoothing off the concrete for the reception of the felt and asphalt.

On top of the smooth concrete is to be applied three-ply felt and asphalt acid and water proofing; each ply of the felt to be properly bedded without superfluous asphalt, all asphalt being applied sufficiently hot to spread and bed without chilling. It is particularly important that the felt and asphalt be formed into a continuous course without superfluous soft material and the Contractor must be especially careful in this part of the work.

On top of the water proofing is to be placed a sufficient amount of stone and Portland cement concrete to bring the floor level to within one-half inch of the finished floor as shown on the drawing. The top of this concrete is to be smoothly finished with a troweled or floated finish to take the final top which is to be composed of ½" of acid proof asphalt mastic.

In the top coating of concrete and in this acid proof mastic is to be formed the drains as shown in the cross sections of the drawing.

The side walls are to be covered to a height of six feet above the finished floor line with asphalt mastic ¾" thick at the top and thickened at the floor line only as much as may be necessary for the stability of the wainscot.

In the construction of this floor, the Contractor is to guarantee absolutely the materials and workmanship and is to guarantee the durability of this floor for a period of five years, any failure to comply with said guarantee to result in the making good by the Contractor of any defects which may show during the named period.

During the course of the construction, the work will be closely inspected by the New York Edison Company and the Contractor must immediately make good any exception taken to material or workmanship. Particular care must be taken by the Contractor that the temperature of the room during the time when concrete is being laid or water proofing being done, is such as will prevent either freezing of concrete or chilling of the waterproofing and especial attention must be given to this point to secure the integrity of the floor.

ELECTRICAL CONSTRUCTION WORK.

85. Vitrified Tile Conduit:

All vitrified tile conduit to be built in the floors, walls or elsewhere located, together with all ironwork for supporting same, are to be furnished by the Company, and the Contractor is to furnish all labor and materials required for locating and laying said conduit in accordance with drawings furnished by the Company and in a manner hereinafter specified.

All horizontal runs of conduit are to be laid on a smooth, even surface of concrete, and are to be well grouted and tied into the concrete, so that by no possibility can they become loosened by the strain of drawing heavy cables through them.

All adjacent runs of conduit are to be laid with broken joints.

All conduits are to be true in alignment, so that no shoulders or offsets shall be formed in the bores. After the conduits are centered, each joint is to be wrapped with a six-inch (6")) strip of asphalted burlap and a thin layer of cement mortar plastered around the burlap.

The Contractor must take every precaution to keep the interior surface of the conduits free from any projections of cement, and to prevent dirt or refuse from lodging therein.

Wherever and whenever work is suspended, the open ends of all conduits must be plugged with a hard wood plug conforming accurately to the opening and the larger end at least one-quarter of an inch (¼") greater in dimension than the opening.

Upon the completion of the entire work and before acceptance by the Company, the Contractor will be required to pass through each line of conduit, from end to end, an iron shod mandrel conforming in shape to that of the interior of the conduit and not more than one-quarter of an inch (¼") smaller diameter.

Wherever runs of conduit terminate in pockets or pull-boxes, the ends of the adjacent conduit must come flush with the inside surfaces of the box; short sections will be furnished for this purpose.

Vertical runs of conduit are to be built in the 40th Street building wall and in the wall separating the electrical galleries from the engine room.

These runs of conduit are to be continuous from the basement floor to the fifth mezzanine floor, except where broken at intervals by pockets formed in the walls to admit cable clamps.

The conduits are to be lined up and each joint wrapped as hereinbefore specified and are to be well tied into the wall on all sides, so as to form a part of the wall and capable of resisting the drawing of cables.

The Contractor is to locate and construct all pockets shown on and in accordance with drawings furnished by the Company.

Behind each pocket, the Contractor is to locate and erect a 6″ x 4″ angle, which will be furnished by the Company. These angles are to be bolted to the columns and well tied into the brickwork.

On the cable floor, the Contractor is to finish the concrete to a smooth level surface one inch (1″) above the tops of the floor beams, and on this surface the tile conduit are to be laid as herein specified and in accordance with the drawings furnished by the Company.

Each line of conduit is to be separated from the adjacent lines by one-half inch (½″) of concrete and each group is to be enveloped with a one-inch (1″) finish of concrete, making each group a solid mass.

86. Iron Pipes:

The Company is to furnish, locate and erect all iron pipes to be used for electrical purposes, as well as the ironwork for supporting the same, with the exception of the pipes for station lighting and power wires, which come under another contract.

The Contractor is to co-operate with the Company in laying of said pipes by carrying his part of the construction to a point which will allow the Company to lay pipes in place, after which the Contractor will complete his work as elsewhere specified.

87. Compartments for Oil Switches and High Tension Busses:

This work is to include the construction of compartments for enclosing and supporting the high tension busses on the first mezzanine floor, the construction of the walls for supporting the oil break switches on the second and fourth mezzanine floors, the construction of the compartments for en-

closing the potential transformers on the third mezzanine floor and the construction of the enclosure for the control pipes on the fifth mezzanine floor.

All ironwork, Alberene stone and porcelain insulators to be used in the above construction are to be furnished by the Company, and the Contractor is to furnish all brick labor and materials required for completing the work in accordance with the drawings furnished, and in a manner satisfactory to the Company.

All brickwork will be of buff brick of a quality elsewhere specified under clause No. 21 with alberene stone blocks and slabs built into the brickwork.

All Alberene stone and openings in the walls must be accurately located by the Contractor and all ironwork and anchor bolts are to be built into the brickwork wherever shown on drawings.

The Contractor is to leave openings in the floors wherever required to allow construction to pass from floor to floor, and after the work is complete, is to finish the floor around said construction in a workmanlike manner.

88. Wire Glass Doors:

The Company is to furnish all wire glass doors to be used in the electrical galleries, and the Contractor is to fit and place said doors in position called for on drawings and in a manner satisfactory to the Company.

89. Slate Flooring:

The Contractor is to furnish and lay all slate to be used for flooring. The slate must be of the best grade, two inches (2″) thick, possessing high insulating qualities and entirely free from cracks, metallic veins and other defects.

Each slab must be perfectly square with one-quarter inch (¼″) bevel on the four top edges and lifting holes must be drilled in each slab.

The slabs must be laid in such a manner that there shall be no open cracks and so that each will be perfectly level and have a solid bearing, making the rocking of the slab impossible.

The Contractor is to furnish and erect the 4″ I beams and channels for supporting the slate flooring on the first floor.

ELECTRIC ELEVATOR WORK.

90. Electric Elevator Work:

The Contractor shall comply with the corporation ordinances, State and other laws, and rules of the City Department and shall procure all necessary permits in connection with the work and pay all fees for same.

The Contractor shall furnish all tools, derricks, scaffold, planks, runs, etc., and all necessary mechanical appliances, including all drawings, templates, etc.; and all measurements shall be made by the Contractor at his expense.

All material and apparatus of every kind and description shall be of the best quality and shall be approved by the Company before being installed.

All work necessary for the complete installation of the apparatus shall be executed in a thorough, substantial and workmanlike manner, to the entire satisfaction of the Company.

The Contractor must properly protect his work from injury and shall remove all dirt made by him at the completion of the work.

The Contractor shall provide all necessary instruments and make such tests before the Company's representative as may be deemed necessary to show the proper fulfillment of the requirements of the specifications.

The hoisting machines shall consist of drum gearing. motor and drum and shall be mounted on a heavy cast iron bedplate, and shall be securely fastened to its foundations. Gears

shall be extra heavy and the winding drum shall be accurately turned and grooved for the cables.

Thrust bearings shall run in babbitted boxes and be provided with automatic lubricators.

All connections liable to work loose shall be provided with an approved locking device.

Motor shall be wound for 250 volts and of highest efficiency, provided with self-oiling bearings, and shall be direct connected with the hoisting machines.

Foundations and supports for the elevator engines are to be provided.

All guides for the car and counterweight shall be of steel, and the overhead sheaves shall be of heavy cast iron, with the shafts running in babbitted boxes, provided with lubricators and drip pans.

The elevators shall be provided with upper and lower limit switches that will apply the brake and stop the car at the upper and lower landings. Each machine shall have a safety brake arranged to apply the instant the circuit is open.

Speed governors must be placed at the top of the elevator shafts and safeties placed under the cars in connection with these governors designed to operate from any excessive speed of the cars no matter what may be the cause, and to bring the cars to a stop gradually and smoothly.

A slack cable device shall be installed to automatically stop the machine in case the car is obstructed in any manner in its descent.

The Contractor shall guarantee every part of the apparatus to be free from defects in material and workmanship, and shall replace any part showing structural defects within twelve months from date of completion.

The lighting fixtures in the cars are to be furnished, also the drop from center of shaft to light in cars. The wiring for the elevator engines and for the light in cars to be done by another contractor.

There will be as follows:

One passenger elevator to travel from the basement to the sixth mezzanine floor, inclusive, a height of 102 feet (approximate).

Two freight elevators to travel from the basement to the third floor, inclusive, a height of 90 feet (approximate).

The passenger elevator shall be capable of lifting a load of 2,500 lbs., at a speed of 300 feet per minute, exclusive of the weight of car, cables, etc.

The freight elevators shall be capable of lifting a load of 4,500 lbs., at a speed of 200 feet per minute, exclusive of the weight of car, cables, etc.

The Contractor shall allow four hundred dollars ($400) for passenger elevator car; this price not to include car uprights, crosshead, safety or platform. The freight elevator cars shall be wainscoted in crimped sheet iron on two sides to a height of four feet, and provided with durable grille work above, and wire screen over the top of car, all to be strongly built and well braced. The cars are to be as large as size of hatchways will permit, which are approximately 7′ 6″ x 7′ 6″ for passenger elevator and 6′ x 7′ and 6′ 6″ x 8′ for freight elevators. The freight and passenger elevators shall be operated by electric control having switch in cars so that the cars can be brought to a gradual stop without shock or jar.

The elevator cars shall be provided with automatic push button indicator boxes and indicator dials are to be furnished on front of elevator shafts at each landing; the indicator dials and box for passenger car and elevator shaft shall be ornamental in design, and all dials and boxes shall be properly adjusted and connected.

Each elevator is to be equipped with not less than six wire cables of Roebling or other approved make.

The Contractor is to furnish the steel gratings under the overhead sheaves of elevators and the protecting shields around counterweights at tops of shafts shall be of such size and construction as approved by the Bureau of Buildings.

ELECTRIC WIRING, CONDUITS, FIXTURES, ETC.

91. General:

This installation will comprise two separate divisions, which will be maintained in separate and distinct systems of tubing, panel boards, etc., throughout the entire building, as follows:

(a) Incandescent and arc lighting will be on the Edison three-wire system, direct current, at 240 volts across the outside wires and 120 volts between either outside and the neutral wire.

(b) The power circuits will be two-wire, direct current, at 240 volts.

Both of these systems shall be supplied with current from the service, the storage battery or the exciter bus bars, with switches so arranged that the feed may be thrown onto either of the three sources at will.

The entire system of light and power throughout the building shall be controlled from a main distributing switchboard to be located on the first (or main) floor, as shown on the plans, and supplied with current as above described. From this switchboard, feeders are to be carried to the various panel boards located where shown on the plans, in the basement and on each floor. From these centers of distribution, circuits are to be run to feed the individual outlets for light and power throughout each floor.

All conductors throughout this installation, whether cables, wires, bus bars, or switches, shall be of amply sufficient cross section to carry the load imposed upon them, without undue heating; and the Contractor shall guarantee all such conductors to be of the said sufficient cross section and shall replace at his own expense any part showing defects in this particular within six months from date of completion.

All cables and wires shall be run in iron conduit tubing of the loricated manufacture and all outlet boxes shall be of standard type, approved by the Company.

Standard pull boxes of an approved type shall be used where possible, but where special pull boxes are required, the same shall be approved by the Company before being installed. Location of pull boxes shall also be approved by the Company.

All conduits, outlet boxes and pull boxes throughout the engine room, office galleries, electrical galleries, first floor and entrance lobby of engine house and locker and toilet rooms in vault under the sidewalk, shall be concealed. This work shall be buried in walls, floors and beam-covering, so that the entire job will give a first-class appearance. In general, these conduits in floors shall be run above the floor beams, buried in the floor filling and bend through the arch, with the outlet box placed in the center of the arch.

In some cases in the above mentioned localities, it may become necessary to place outlet boxes on the beams instead of in the arches, although the beams are not to be covered with masonry. The conduit leading to such a box shall be run along under the center of the flange of the beam, parallel thereto, and neatly secured with clamps. If any such cases as here described occur, anywhere throughout the installation, the work shall be performed by the Contractor without any extra charge to the Company.

In the toilet and locker rooms in the vaults under sidewalks, where a tile finish is to be put on, all ceiling lights shall be placed upon the beams. To reach these, the conduit shall be buried in the beam covering. It shall be run out from the wall under the center of the beam flange, parallel therewith and clamped thereto.

In the basements of engine house and boiler house, boiler rooms, around and above the coal pockets and in the coal tower on the bulkhead, the conduits, outlet boxes, etc., will be exposed under floor beams, but buried in walls. It is desirable that they shall be concealed even in these localities, and the Contractor will therefore use every endeavor to conceal the work as above described wherever possible even

though it is not indicated in the plans or described in the specifications as concealed work.

The locations shown for switchboards and panel boards are fairly accurate, but ceiling outlets are always to be placed either on beams or in center of arches, as above described, although the scale might indicate otherwise.

The layout of conduits, however, is only diagrammatic, it being left to the Contractor to run conduits in the best and most convenient manner. For instance, the conduit may be run in any direction through walls or across floors to make the shortest and easiest run, if it is to be covered with masonry or cement, etc., when finished; but, where exposed on under side of beams or the like, in basements, boiler rooms, over coal pockets, and in coal tower, the work must be carefully executed and neatly put up. Conduits thus exposed shall run straight, and either parallel to or perpendicular to beams, with ninety-degree bends, and all shall be disposed as symmetrically as possible.

No boxes or conduits are to be secured to the columns or beams with bolts; clamps must be used in all cases. Drilling of beams or columns will not be permitted under any circumstances. Furthermore, it is desirable that the work shall be pushed ahead of all mason work, to avoid the necessity of cutting into finished floors or walls.

The wiring plans do not show the complete station equipment to be installed in the building. It is, therefore, necessary that the Contractor and his foreman on the job shall familiarize themselves with the architect's and various other plans for steam heating, cable duct work, switchboard work, battery work, machinery and boiler layouts, etc., to avoid placing the conduits, outlets, etc., in such locations that they will interfere with said work as laid out, which would thereby necessitate their being moved.

If the Contractor is in doubt as to the location of any such apparatus, fixtures or machinery, he shall apply to the Company for positive information.

If, on account of the failure of the Contractor to locate his electrical material in accordance with the above, it becomes necessary to move conduits, outlets, etc., the same shall be done by the Contractor without any extra charge to the Company.

All material, apparatus, etc., of every description, called for in these specifications and drawings, shall be of the best quality and shall be approved by the Company before being installed.

All work necessary for the complete installation of the apparatus, etc., shall be executed in a thorough, substantial and workmanlike manner to the entire satisfaction of the Company.

The Contractor shall guarantee all work in this system to be free from defects and shall replace any material showing such defects within six months after completion thereof.

All wires for the branch circuits shall be run on the loop system. All fuses shall be placed on the panel boards and main switchboard, and they shall all be of the Sachs Noark enclosed pattern, type "C," or equal thereto.

The arc lamps shall be controlled from the same panel boards as the incandescent lamps, and each arc lamp shall be on a separate branch circuit.

The laws, rules and regulations of the Department of Water Supply, Gas and Electricity, and the New York Board of Fire Underwriters, regulating this class of work must be complied with, and the Contractor must furnish the Company with the usual certificates of inspection as to the wiring and fixtures from these respective Departments before the work will be accepted.

The Contractor is to supply and erect all panel boards, switches, conduits, outlet and pull boxes, hangers, wires, cables, fixtures, heaters, etc., and all labor for erecting same to make the entire job complete in all its details, as called for in these drawings and specifications, to the complete satisfaction of the Company.

The Contractor is not to supply or erect the main lighting and power switchboard, nor the feeds to same from the service, the station bus bars and battery. These will be supplied and installed by the Company. He shall supply and install complete the entire system of conduits, wires, etc., including every detail, from the lighting and power switchboard to the fixtures, motors, etc., and including the fixtures, but not the motors.

The specifications are intended to include everything necessary to completely finish the work, and the Contractor is to supply all labor, materials and appliances necessary to accomplish that result, whether or not hereinafter set forth in detail, so as to make a thoroughly and completely finished job in every respect.

All the work described in these specifications or shown on the drawings is to be executed to the true intent and meaning of said specifications and drawings. It is further stipulated that these specifications and drawings are intended to supplement each other, so that any work shown in the drawings and not described in the specifications, or vice versa, is to be executed as if it were described in the specifications and set forth in the drawings.

As the work progresses, some other details may become necessary, for which the Contractor shall apply to the Company.

92. SWITCHBOARD:

The main switchboard for feeding and controlling the light and power circuit for this building shall be arranged with the switches for the light and power grouped separately, with separate meters for each group. All, however, will be fed from the same set of bus bars. Each lighting feeder shall have a triple pole, single throw knife switch and each power feeder a double pole, single throw knife switch.

As it is at present undecided as to whether the conduits will come in at the top or bottom of the main lighting and

power switchboard, the Contractor shall apply to the Company for accurate information on this point before finally arranging for securing these conduits in their places.

This switchboard, as stated above, will be furnished and erected by the Company.

93. Panel Boards:

Wherever it is possible, panel boards shall be buried in the walls of the building to make a first-class job of concealed work.

All panel boards that are thus buried in the walls shall be incased in wooden boxes lined with sheet iron, having a gutter at least three inches wide, and a slate lining surrounding the panel; they shall be supplied with a trim and a door as hereinafter specified. All boxes that are thus buried shall be set so that the front edges of the boxes will come flush with the finished wall and the trim will lap over on the face of wall.

All panel boards that must be exposed on the face of walls or on columns, in such places as the coal bunker floor, and in the coal tower on the bulkhead, shall be incased in cast iron or sheet iron boxes. They shall each have a slate lining around the panel, a slate lining on the inside of the door and a gutter at least 3 inches wide on all four sides of the panel.

Each panel shall have fuses and switches in the main leads and fuses and switches in each branch circuit. They shall be fed from taps taken off the main feeder; that is, in no case is a feeder to be run through the bus bars of one panel on its way to a more distant panel. Such a feeder shall be run around the gutter and taps taken from it into the bus bars of the panel. Or it may be run directly into the bus bars of the panel through the main switch and fuses and a tap taken off below the main switch, on the face of the panel, as a subfeed to a more distant panel. Fuses shall be placed in these branch leads.

Each panel-board shall have the number of branch circuit switches called for on the plans and schedule.

Each panel-board shall have numbers placed on every switch and corresponding numbers on a schedule of circuits. This schedule shall be placed on the face of panel, in boxes with glass doors, or on the inside of the door in iron boxes. It shall be made in the form of card holders so that the cards will be removable and the face of the card shall be covered by a piece of mica or celluloid.

As the feed to all the turbine lights and boiler room lights will be in duplicate, the lugs provided for the feeds on the panels controlling such lights must be arranged to receive the two feeds.

All small terminal lugs may be cast composition, copper plated and polished, but where currents of over 100 amperes are to be handled the lugs are to be of pure cast copper and polished.

These panel-boards shall all be made exactly in accordance with the Company's standard drawings for same. The trim for these panel-boards shall also be made from the Company's drawings and shall correspond with the surrounding finish. In the offices, the electric galleries, the entrance lobby and the toilet and locker rooms in the vaults under sidewalk, the trim will be of copper and bronze, which will be supplied by the masonry Contractor. The trim on the panel boxes in the basement of engine house, the entire Boiler House and the coal tower on pier shall be neatly made of iron with strong hinged doors and suitable catches, to be approved by the Company.

94. SWITCHES:

All the switches on these boards are to be carefully and substantially constructed of the best material throughout and are to be of a design approved by the Company. They are to be strongly put together with good contact surfaces and cross section of conductors as specified below, and well and thoroughly secured to the bases upon which they are mounted.

Particular attention shall be given to the handles and yokes that they shall be thoroughly and strongly secured to the blades by suitable bolts and studs. The clip blocks are to be of sufficient thickness to securely hold the clips, and said clips when set in place, shall not only be sweated in, but also secured with riveted pins. All the switches shall be well lined up, both vertically and horizontally. The blades shall enter the clips true and square and make proper contact.

All switches must operate smoothly and easily, and in every respect must have a first-class finish.

Switch handles are to be of hard wood, black japanned, for large switches, and of black fiber for switches of 50 amperes capacity and under.

All exposed metal parts of the switches and panels throughout the entire installation shall be highly polished and burnished, and finished in a first-class manner, so as to give the best possible appearance, except in the coal tower on pier, and in the coal pockets and ash rooms in the Boiler House In these places they may have a plain finish.

All switches throughout this entire installation shall be made in accordance with the Company's standard drawings.

95. COPPER:

In the construction of these switches, switchboards and panel-boards, wrought copper shall be used wherever possible, and this shall be high grade cold rolled bar copper of not less than 98 per cent. conductivity. Where it becomes necessary to use castings, these shall be of the purest cast copper without blow-holes, sand-holes or defects of any kind and shall be of at least 65 per cent. conductivity.

All the rolled copper for these switchboards shall be figured on the following basis: In cross section the current density shall not exceed 1,000 amperes per square inch; sliding contact surfaces shall not exceed 75 amperes per square inch; bolted contact surfaces shall not exceed 150 amperes per square inch; sweated contact surfaces shall not exceed 250

amperes per square inch. Current density for cast copper in cross section shall not exceed 600 amperes per square inch.

The foregoing will hold good not only on the main switchboard, but also on all panel-boards throughout the entire installation.

96. Fuses and Circuit Breakers:

All fuses shall be Sachs "Noark" enclosed fuses, type "C," or equal thereto, on all switchboards and panel-boards, unless otherwise called for on the plans. Fuses shall be used on all switches up to and including 400 amperes capacity. The metal parts of fuses are to be polished in all panels except those in basement of Engine House, the entire Boiler House, and the pier.

Above 400 amperes, circuit breakers shall be used, of a type which shall be approved by the Company.

97. Slate:

All slate supplied on this job for switchboard or any other electrical purpose shall be of the best grade and entirely free from cracks, metallic veins and other defects. It must possess high insulating qualities, which will be determined by the purchaser in the following manner:

After the slate has been drilled and is ready to receive the switch or other parts to be mounted on same, a resistance measurement will be made between any two holes, which must measure not less than one megohm. This test applies to all holes through the slate that are one inch or more apart.

Wherever a certain finish is specified, it shall be understood to mean that face, chamfers and edges shall be so finished; and it must be perfectly smooth with a high polish and thoroughly baked on.

The finish on all the slate shall be such as will harmonize with adjacent conditions, as approved by the Company.

In furnishing slate in which certain drilling is specified, the inside surface of all holes and the back of the slate must

have one coat of high grade black insulating varnish or paint.

Slate furnished with drilling and switches mounted thereon must first be treated as above, then thoroughly baked for at least 36 hours before the switches are mounted. In mounting the switches, all heads and nuts of holding screws or bolts on the back of the slate must be let into counter-bores and the counter-bores filled flush with an insulating compound which will not become soft, or in any way change its form, at temperatures up to 100° C.

In furnishing the slate, it is understood that the Contractor guarantees that same shall conform to these specifications in every particular, and if on test the slate is found not to conform to the specifications in any one or more details, the purchaser reserves the option of replacing the defective slate at the expense of the Contractor or returning to the Contractor the defective slate with whatever may be mounted thereon or intended to be used with the same. All expenses of transportation, handling and boxing because of failure to meet specifications, to be borne by the Contractor.

98. CONDUITS:

No branch circuit conduits are to be less than ¾-inch loricated tubing. Each circuit shall be run in a separate tube, except in certain special cases, which will be determined by the Company's Engineer.

The sizes of all the other conduits are marked upon the plans and these sizes are to be installed as called for.

The conduits for the feed cables from the service, the battery and station bus bars to the lighting and power switchboards will be supplied and installed by the Company.

Conduits are to be installed for telephones as called for on the plans, but no wires are to be run in them under this contract. There will be about forty outlets on the telephone circuits.

99. WIRES AND CABLES:

No branch circuit wires shall be smaller than No. 12 B. & S. gauge. The sizes of all feeders and risers are marked on the plans and these sizes shall be installed as called for.

The feed cables from the battery service and station bus bars to the lighting and power switchboard will be supplied and installed by the Company.

The lighting feeders will be three-wire throughout and the branches two-wire. The power feeders and branches will be two-wire throughout.

The wiring throughout this installation shall be in accordance with the following:

All wire and cable shall be of the very best rubber-covered moisture-proof insulation, of either Habirshaw, Grimshaw, Okonite, Bishop, Roebling or of any other manufacture equally as good and must conform in every particular, wire, insulation and covering, to the specifications of the National Electrical Code. They shall also be in accordance with the rules of the Board of Fire Underwriters, in that all wire and cable drawn in iron conduit tubing shall be double cotton covered. The following are exceptions to this:

The feeds to the main lighting and power switchboard shall be lead-covered cables. Any cable larger than 500,000 C. M. may be braided station cable rubber insulated, unless it is run below the floor of the basement, in which case it shall be lead-covered and waterproof.

All wires and cables that are run below the basement floor level shall be lead-covered and waterproof.

Wherever circuits run in close proximity to steam pipes, boilers, engines, ash chutes, heater rooms or in any place where the temperature exceeds 125° Fahrenheit the wires and cables composing such circuits shall be asbestos covered, moisture proof wire of the best quality. This wire shall be used throughout the Boiler House and the basements, and on the turbines.

100. HEATERS:

The Contractor shall supply and install electric heaters of 2,000 watts capacity where located on the plans. These heaters shall be connected to the 240-volt power circuits, two in series.

The electric heaters shall be controlled from panel-boards, which in every case will be separate from the lighting panels.

101. FIXTURES:

In making his proposal, the Contractor shall allow Six thousand dollars ($6,000.00) for fixtures. This allowance shall include the following:

Arc lamp brackets in engine room.
Arc lamp brackets and posts, on coal tower and bulkhead.
Electroliers at entrance to building.
Dome lights.
One-light pendants.
Three-light pendants.
Six-light pendants.
Wall brackets.
Flexible arm brackets on boilers, etc.
Special wall brackets in vestibule.
Special show-window pendants in front of switchboards.
Special four-light battery room pendants.
Special three-light wall boxes, glass front.

The arc lamp brackets called for around the sides of the engine room shall be ornamental bronze plated brackets. The height of these brackets from the floor is shown approximately on the plans.

The arc lamps in the boiler rooms and over the coal bunkers shall be hung from the beams on hooks in a good substantial manner. Where they are in a position to be conveniently reached from platforms, they may be hung directly on the hook; but, in all other cases they shall be provided with pulley and cord so that they may be lowered for trimming.

The arc lamps on the coal tower shall be hung from suitable standard wrought iron pipe brackets, with pulley and cord where necessary. Standard arc lamp posts shall be used.

At the main entrance of the building, two bronze electroliers of ornamental design are to be erected, each to carry a cluster of incandescent lamps.

The dome lights called for in the vestibule and elevators shall be the standard countersunk dome light fixture with ground or opalescent shade, bronze finish.

All one-light pendants called for shall be securely hung from the beams or center of arches with ½-inch brass pipe, canopy and white enameled iron shade. No drop cords shall be used. The height of these pendants shall be about eight feet from the floor unless otherwise directed by the Company. Over the boilers, loricated tubing shall be used instead of the brass pipe.

Three-light and six-light pendants shall be similar to the one-light pendants except that they shall have three and six lights in a cluster, heavier brass pipe and larger enameled iron shades, respectively.

All wall brackets called for shall be well secured to the wall outlet boxes at a height of about 6′ 6″ from the floor or stair landings, and shall be of a neat bronze pattern with canopy and key socket.

Flexible brackets on the boilers, over boiler feed pumps, etc., shall be made of waterproof flexible tubing of the proper length, and shall have waterproof sockets, and asbestos covered wire, as specified for high temperatures.

The special wall brackets called for in the vestibule shall be of an ornamental design in bronze. The height of these brackets from the floor will be given on the architectural plans.

The special pendants called for in front of switchboards shall be show-window pendants with sufficient brass or bronze pipe drops to properly support the frame which carries the gang of lamps. The casing of this fixture is arranged so as to throw the light on the switchboard through a ground glass

front and protect the eyes of the operator from the direct rays of light.

The four-light pendants called for in the battery room shall be the Faries porcelain cluster, four-light, with enameled sheet iron reflector, hung on loricated tubing from a ceiling outlet box, and shall be made as shown on the Company's standard drawings.

The special three-light wall box in pump room and ash room shall be a cast iron box, containing three lamp sockets and designed to be set into the wall or on a column between the flanges. It shall be made as shown on the Company's drawing.

All individual switches where shown on a line to a lamp or set of lamps shall be flush push-button switches of a standard make, such as the Hart Switch Company, or equal thereto.

The wall receptacles called for in the basement of the Engine House, in the Boiler House, in the vaults, etc., shall be the iron box receptacles containing a socket for single lamp or lamp cord. The ceiling receptacles in the same location will be of the same type.

Where baseboard receptacles are wanted in the various offices, they shall be the standard type of flush washboard receptacles with plug such as is made by the Hart Switch Company, or equal thereto, and shall be located as directed by the Company's Engineer.

Where floor receptacles are wanted, same shall be located as the floor is being laid, under the direction of the Company's Engineer. These floor receptacles shall be the standard Chapman type, or equal thereto.

On the girders in the engine room, the 8-candle-power incandescent lamps called for shall be held in keyless sockets properly secured to said girders so that the lamp will extend through the sheet iron moulding which shall be furnished and placed upon the girders by the Contractor.

The fixtures on the working circuits shall be receptacles similar in design to the Chapman floor receptacles, but arranged in waterproof outlet boxes through which the circuit

may pass on the loop system in the same manner that it does through the ordinary outlet box. They shall be made as shown on the Company's drawing.

When any of the above fixtures are called for on the plans as "waterproof," they must be thoroughly and entirely deserving of that description. They will not be accepted by the Company unless they are perfectly waterproof.

All material and fixtures throughout the entire building shall be of the best quality and workmanship, and shall be approved by the Company before being installed, as herein specified.

The Contractor is to furnish no arc nor incandescent lamps. These will all be furnished by the Company.

102. Power Lines:

On the power lines, the Contractor shall wire to all the motors shown and called for on the plans in the entire building, as well as in the coal and ash tower on the bulkhead. These comprise ventilating fans for battery room, etc., elevator motors, ash trolley, ash hoist, ash conveyor, coal conveyor, coal hoist, machine shop, cranes, etc. In the case of the trolley road in the basement of Boiler House for handling of ashes and the cranes above the turbines, the Contractor shall furnish and erect everything pertaining to the supply of current to this installation, excepting the trolley wire, supports, and protecting covers for same. At the end of the line, in each case he shall furnish a fused switch in a panel box just before reaching said trolley wires.

In the case of the elevator, he shall run his leads to and connect to the line switch furnished by the elevator Contractor on the elevator motor starting mechanism.

In all other cases, he shall run his lines to and connect to the line switch provided with the motor starting apparatus, and run the line in conduit; from the starting apparatus to the motor.

The Contractor shall, however, furnish no motors nor starting apparatus.

103. ENGINE ROOM:

The lighting of the engine room is to be accomplished by arc lamps hung from the walls on brackets, and by incandescent lamps placed upon the roof girders. These arc lamps will be controlled from panel-boards conveniently located on the wall of the engine room proper, where shown.

The girder lights will be 8-candle power lamps, spaced about eighteen inches apart, forty per girder. These lamps will be controlled from a panel-board on the sixth mezzanine. The location of this board is shown upon the plans.

The engine room basement will have incandescent lamp outlets distributed around in the locations called for, including the vault in front of the engine room, and controlled from panel-boards as shown on the plans.

104. TURBINE LIGHTING:

Each turbine generator is to have an individual panel-board for controlling the lights, mounted upon the wall near the machine. Each turbine will have about eighty incandescent lamps, distributed over the apparatus in locations called for on the drawings.

105. ENGINE ROOM MONITOR:

This shall be lighted by incandescent lamps, the control of which will be included in the panel on the sixth mezzanine.

106. BATTERY ROOM:

The lighting of the battery room shall be done by special four-light clusters with enameled sheet iron shades, hung from the ceiling arches by loricated tubing from outlet boxes secured thereto. The conduit leading to these boxes will be run above the ceiling beams and bend through the arches.

107. Electric Sign:

The electric sign on the roof shall have about five hundred 8-candle power incandescent lamps, controlled from a panel on the sixth mezzanine.

108. Electric Galleries and Office Galleries:

In the electric galleries and offices, incandescent lamps and working receptacles are to be installed as called for on the plans, especial care being taken to see that lamps are located exactly in the right places around D. C. and A. C. switch-boards, oil switches and in offices. And the Contractor shall consult the Company's Engineer finally on locations of these lamps just before placing the outlets, to make sure that no changes have been made in the plans.

109. Stair and Elevator Lights:

On each landing of the stairs, a one-light bracket is to be installed. Each elevator is to have a three-light dome fixture. These circuits will be controlled from the panel-boards on the lower floors nearest to the stairs and elevators upon which they are located.

110. Boiler Room, First Floor:

Arc lamps will be hung in main aisles opposite each passageway between boilers. Incandescent lamps on flexible arm brackets carrying one light each shall be placed at the water gauge glasses and one at each steam gauge. One-light pendants shall be hung where called for above the boiler drums, and outlets on the working circuit distributed around the boilers and behind them in locations called for on plans. These lamps will be controlled from five panel-boards, as shown.

111. Boiler Room, Second Floor:

The lighting in this floor is a duplicate of that in the first floor, excepting in regard to the lighting on the stairs.

112. Boiler House, Third Floor:

This floor will be lighted with arc and incandescent lamps located as shown on the plans. A number of working outlets are also to be placed as directed by the Company's Engineer. These will all be controlled from two panel-boards in locations called for.

113. Boiler House Monitors and Coal Pockets:

The monitor passageways will be lighted with incandescent lamps and have a few working outlets.

Arc lamps shall be hung over the coal pockets as shown on the plans, and all shall be controlled from the panel-boards located on that floor.

114. Coal Tower on Bulkhead:

Arc lamps shall be hung on the outside of the coal tower at each corner, and on outriggers over the water, sufficiently long to hold the lamp over the middle of a coal barge lying along the bulkhead. These outriggers, or "mast-arms," as they are usually termed, shall be so hung and pivoted that they may be swung down for trimming the lamps from the bulkhead, and also may be swung up against the tower, so as to clear the masts and rigging of a boat passing close by.

There shall be a few arc lamps up in the coal tower and incandescent lamps around the various engines and motors. Also incandescent lamps shall be mounted out on the boom overhanging the river. All of these lamps that overhang the river shall be so guarded and shaded that the light from them shall not shine upwards into the eyes of the operator in the tower above, but the rays of light shall be directed downwards into the coal barge and onto the traveling bucket.

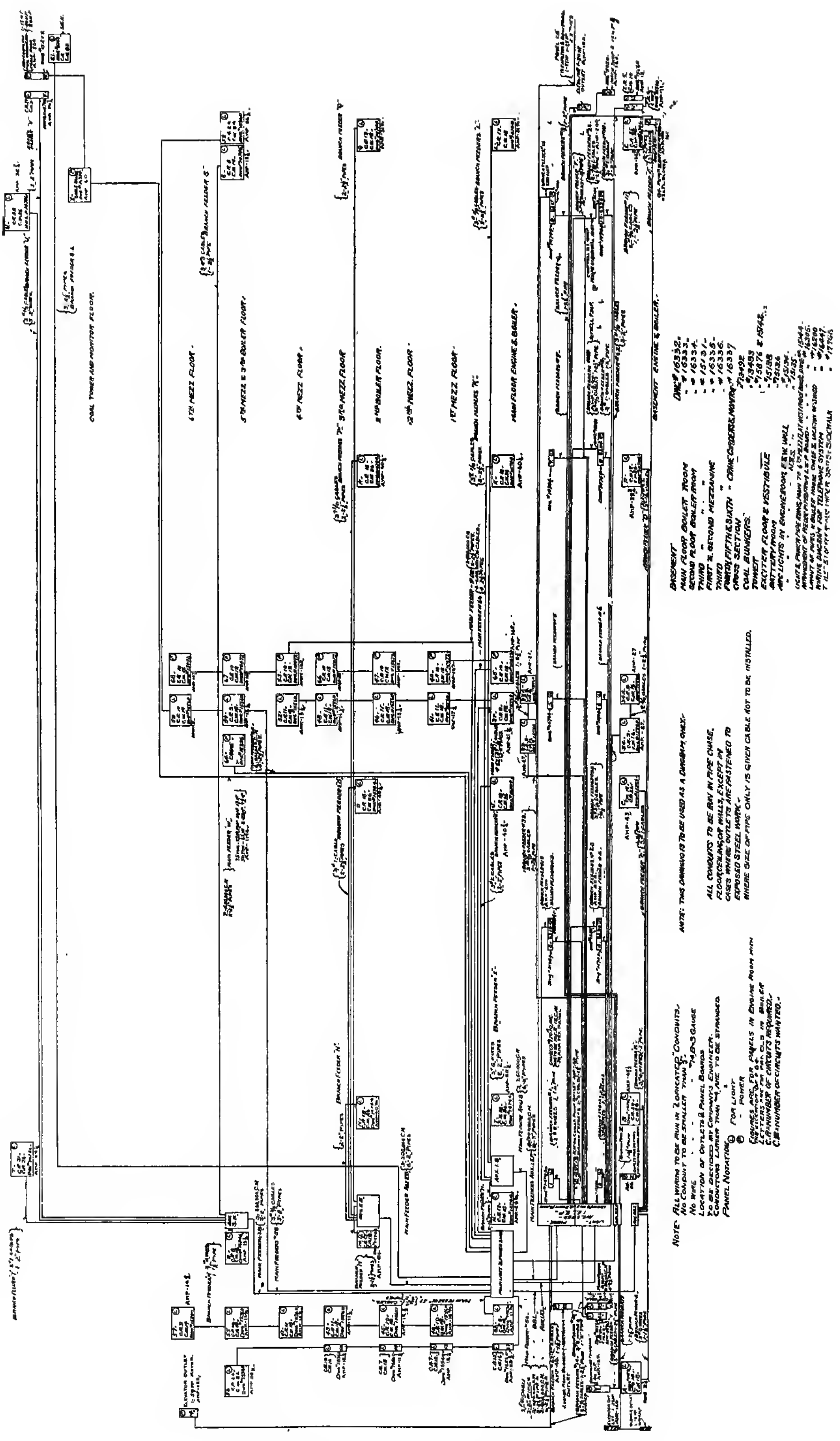
Incandescent lamps shall be placed also on the bridge between the coal tower and the Boiler House, all as shown on the plans.

115. BULKHEAD LIGHTS:

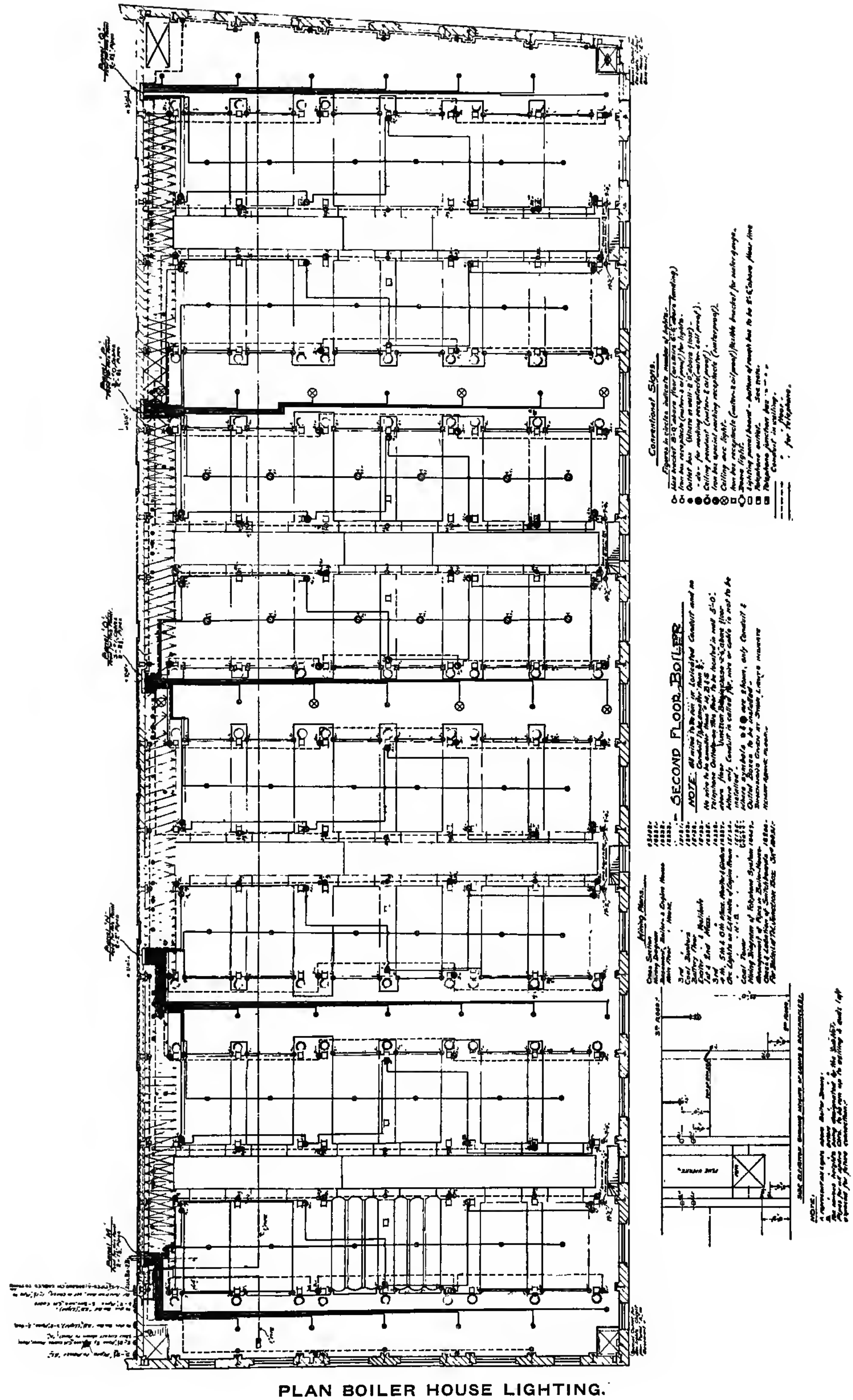
On the bulkhead between the building and the coal towers, arc lamps shall be located as shown on the plans. These arc lamps shall be carried upon suitable standard arc lamp posts.

116. NOTE ON NUMBER OF LIGHTS, FIXTURES, ETC.:

The Contractor will be required to wire to the outlets, lamps, fixtures, boxes, etc., on the following schedule, but should there be a few more or less on account of changes determined upon at a later date, the extra charges, or rebate, as the case may be, for such changes shall be adjusted between the Contractor and the Company, before the work is performed.



WIRING DIAGRAM STATION LIGHTING.



PLAN BOILER HOUSE LIGHTING.

SPECIFICATIONS

Accompanied by Drawings for the

COAL AND ASH HANDLING MACHINERY

of the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. Being a part of contract dated January 2, 1906, between the Mead-Morrison Manufacturing Company, Contractors, and The New York Edison Company.

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1. General Description of the Work:

The work to be furnished under this contract consists of:—

A. All the machinery for two unloading towers, including boom, bucket, hoisting and trolley engines, sheaves, hinge, cables, guys, crusher and motor, gates and operating mechanisms and all apparatus which goes to make up a complete tower.

B. The complete machinery for one ash conveyor, including buckets, links, loaders, trippers, drivers, traction and sprocket wheels, rails, hangers, guides and all other mechanisms necessary for a complete conveyor.

C. The complete machinery for two endless rope cable roads, including driving mechanisms, cars, grips, trippers,

cables, sheaves, takeups, idlers, bearings, track, ties, scales, fillers and all other mechanisms necessary to a complete cable road.

D. The complete machinery for one ash railroad, including three (3) electric storage battery locomotives, cars, track, ties and switches, etc.

The Contractor is to install same as specified, excepting the track, ties and switches, etc., for the ash railroad, providing all bolts and other necessary fastenings.

2. Work to be Furnished by the Company:

The Company will provide all necessary excavations, foundations, structural steel supports and certain hopper and chute work as noted on the drawings, also the steam, exhaust and drip connections to all engines, the wiring and cable connections to the starting boxes of all motors and from the starting boxes to the motors, inclusive of the necessary switchboard construction. The Company will cover the sides and roof of the steel structure and will build the ash railroad, the Contractor to furnish all of the material therefor, as herein specified.

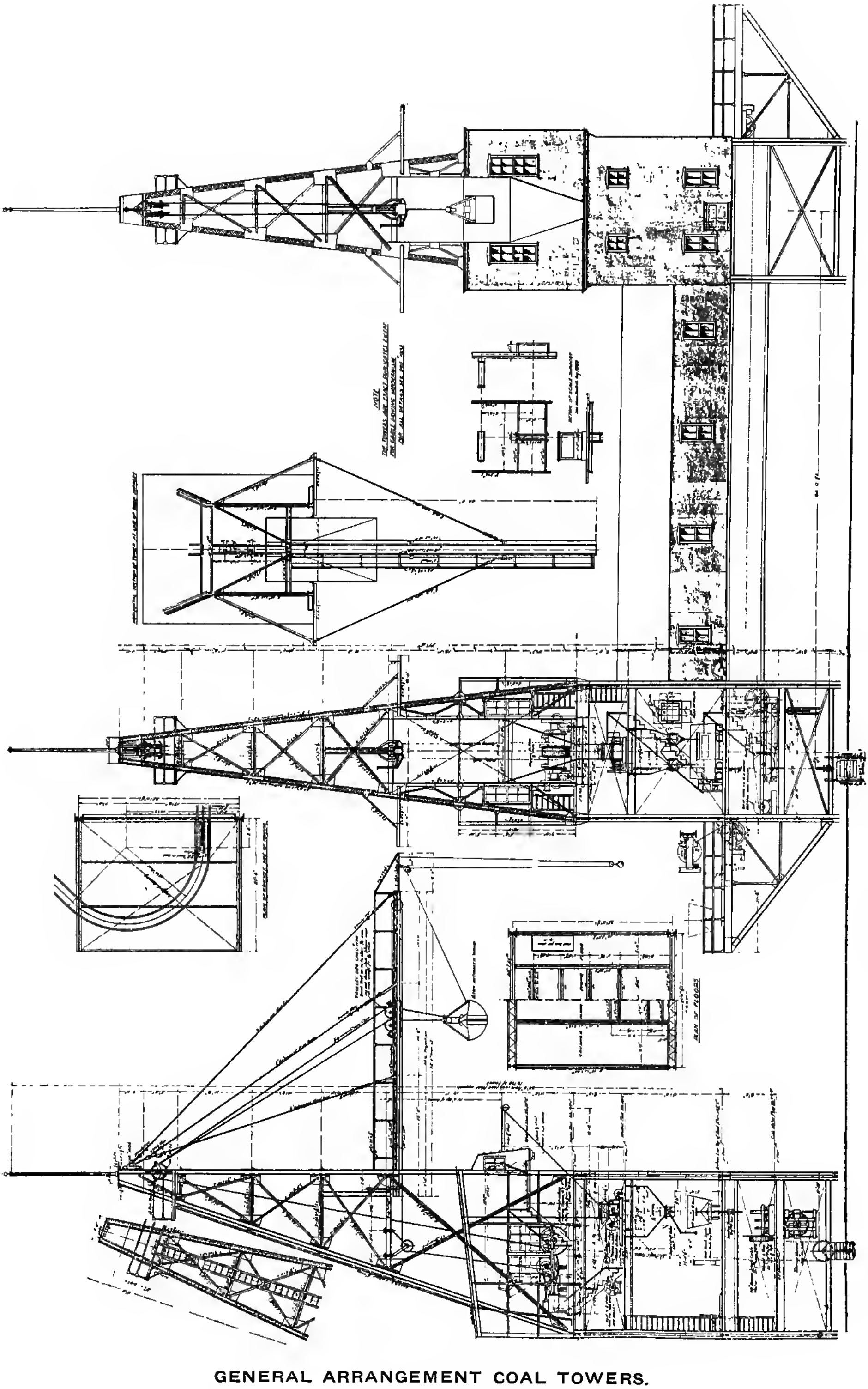
3. Coal Handling Towers:

The towers are to be of the "two man" type, fitted with two-drum, direct connected bucket engines, single drum, direct-connected trolley engines, automatic bucket, hinged boom with galvanized steel rope supporting guys and manila side guys and single roll swinging block crushers with belt and motor drive.

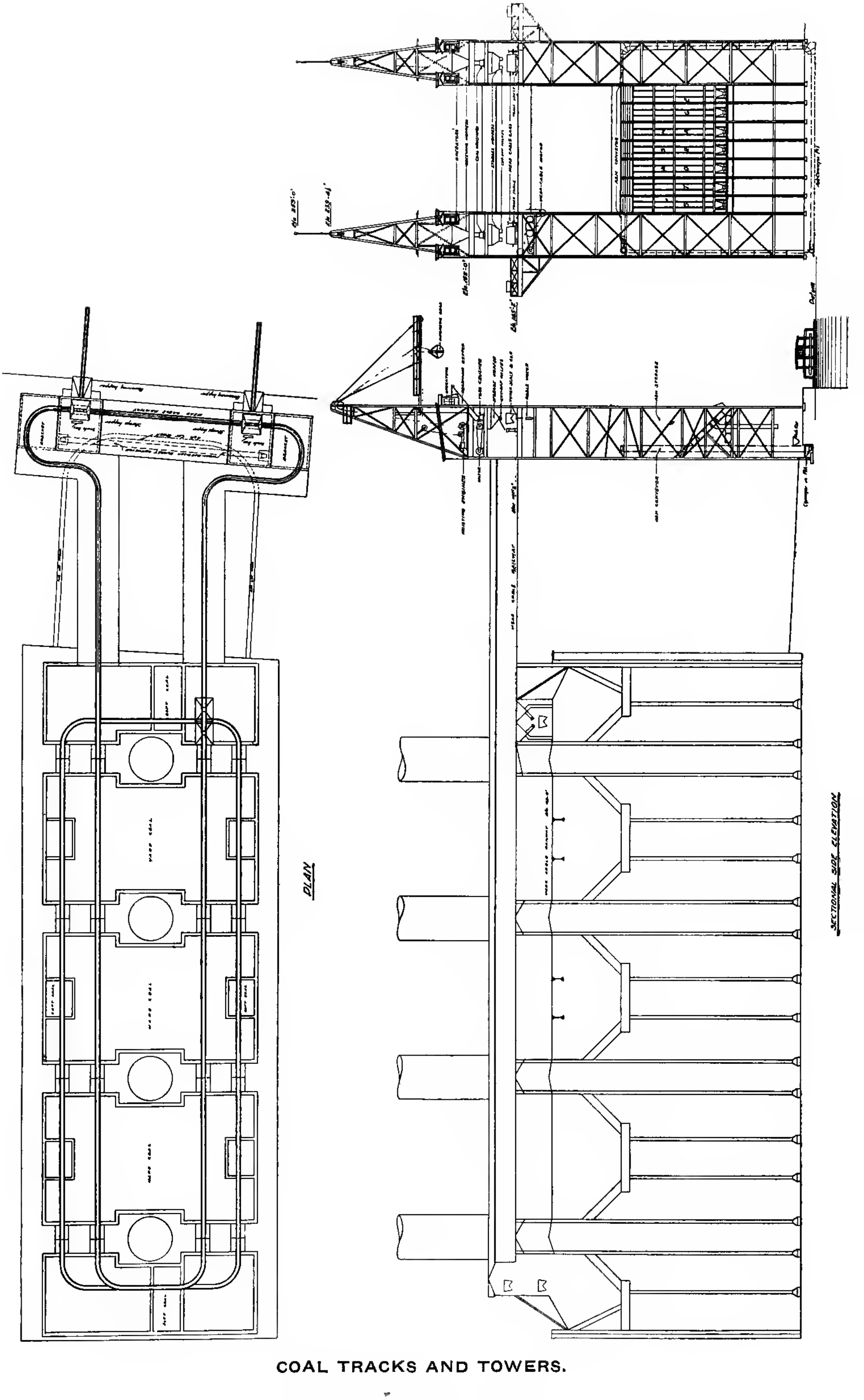
4. Direct Acting Bucket Engine:

The design and dimensions of this engine, will be substantially as follows:

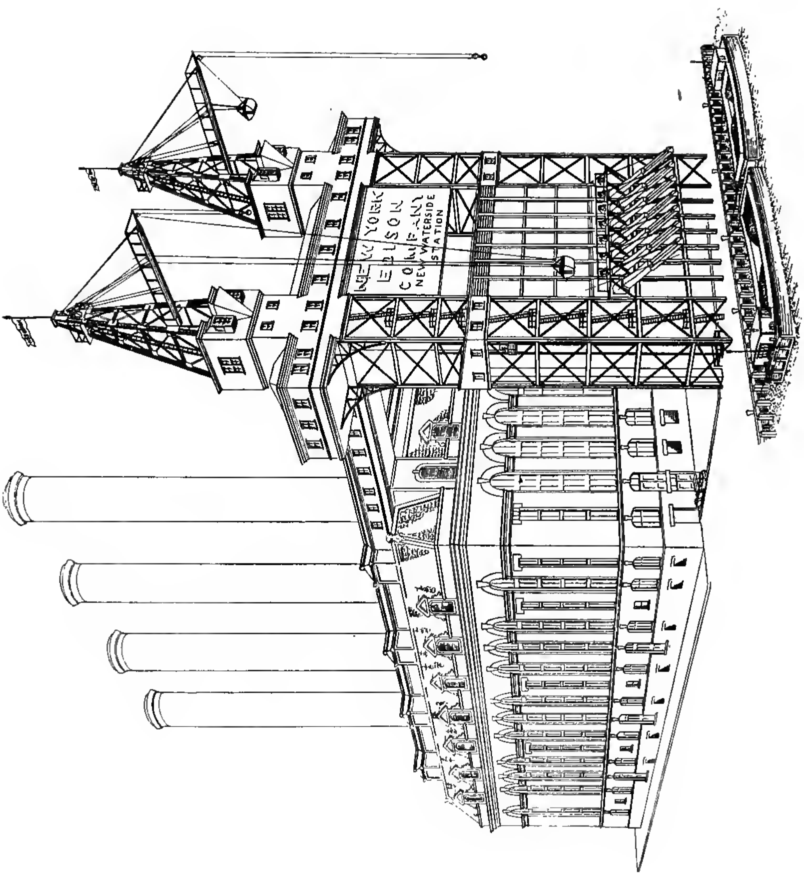
This engine will be double, having cylinders 14″ diameter by 24″ stroke, with two drums 24″ diameter on the crank shaft.



GENERAL ARRANGEMENT COAL TOWERS.



COAL TRACKS AND TOWERS.



PERSPECTIVE OF COAL TOWERS.

Each drum will be provided with a suitable leather covered conical friction surface, engaging a corresponding surface in the adjacent side of the friction member centrally located on the crank shaft between the drums.

Each drum will be lagged on the wearing surface with ½″ steel, and provided with a suitable clamp for securing the end of the hoisting rope, and an oil reservoir for lubrication. The central friction member will be ribbed or otherwise so designed as to have a large radiating surface to dissipate the heat generated in lowering the bucket. All mechanism for throwing the friction members into and out of engagement are to be of ample proportions, having means for adjustment and lubrication, those parts subject to wear to be readily accessible and easy of renewal.

5. Bucket Engine Details:

The crank shaft will be of hammered steel. The connecting rods will be of steel, forged and finished all over, having solid ends with adjustable bronze boxes. The piston rods will be steel, threaded and screwed into the crossheads and secured by checknuts. They will have taper fit 3″-1′ in the pistons, and secured with piston nuts having suitable locking device.

The pistons will be of one piece, cored, with suitable rings. Crossheads will be of the locomotive type—inverted. Reciprocating parts will be counterbalanced to prevent vibration. Valve motion will be generously proportioned, having large wearing surfaces. A balanced "D" valve will be used. Frame is to be heavy and strong, well braced and ribbed. An automatic brake capable of sustaining the load at all points, will be provided to prevent backing down of the engine.

6. Direct Acting Trolley Engine:

This engine will be double, having cylinders 12″ diameter by 15″ stroke, with one drum on the crank shaft 12″ diameter. This drum will have a suitable friction on one end and a hand brake on the other, controlled by the trolley man. The de-

tails of this engine will be similar to those of the bucket engine.

7. WEIGHTS AND DIMENSIONS:

The weight of the bucket and trolley engines combined is to be not over 19 tons; the extreme length of the bucket engine 14′-0 ½″; the outside width of frame 9′-6″; width outside to outside of cylinders 13′-0″.

8. AUXILIARIES:

All engines of whatever size will be provided with the necessary wrenches, oil cups, drain cocks and lever connections for working same. A 4″ Sullivan valve for the bucket engine and a 2″ chronometer valve for the trolly engine will be furnished. A Richardson (double) automatic sight feed oil pump will be furnished and connected to each bucket and trolley engine.

9. OPERATING GEAR:

Both buckets and trolley engines will be provided with the necessary friction and brake levers, suitable to take connection from the operating shafts. The necessary operating shafts, bearings, sleeves, levers and connections, latest improvements and adjustments will also be provided for both engines.

10. TEST:

Each engine will be thoroughly tested before leaving the factory and will be delivered ready for service. All parts will be made to jigs and templates and must be interchangeable, so that repair parts can be readily supplied when required. The material, workmanship and construction of these engines will be thoroughly first-class in every respect.

11. Automatic Bucket:

The capacity of these buckets will be 1½ tons and they will weigh with the chain not over 4,800 lbs. each. The shell will be made of ⅜″ flanged steel plate with corners of varying radius and furnished with heavy jaw, running all the way around the mouth. The hinges will be cut solid from 1″ steel plate, riveted along the upper edge of the shell. The back of each shell will be reinforced at the top by a heavy steel casting, running across from side to side. The casting will be constructed with lugs, to which the links will be pivoted which connect the top head with corners of the shell. The halves of the shell will be pivoted to the connecting shaft, 2½″ diameter, which runs through the cast iron bottom head, which carries the chain sheaves. The links connecting the top head with the shell will be made of 3″ diameter wrought iron. The top head which carries the upper sheaves will be a steel casting provided with a renewable fair leader, to prevent the chain from twisting as it is led down to the sheaves. The sheaves in the top head will be twisted in relation to those of the bottom head in such a manner that the chains will lead true and parallel between the upper and lower sets of sheaves. The sheaves will be bronze bushed and grooved for ¾″ opening and closing chain. The holes in the hinges through which the pivot pin passes and all other parts of the bucket mechanism subjected to wear are to be provided with hardened steel bushings. The bucket will be furnished complete with the necessary amount of ¾″ opening and closing chain and counterweights, which must not impede filling.

12. Boom and Trolleys:

The booms for the towers will be made of two 12″ channels, reinforced with two 8″ channels, one on each side of the boom. The channels are to have a removable wearing strip on the top flanges, with countersunk bolts, so as to facilitate renewal. Suitable attachments will be provided on the boom for the fastening of the guys and a suitable railing to allow

for easy access to the sheaves at the outer end. The boom hinge will be of the universal "T" type.

The trolleys will be of the two sheave type with channel frame. The carrying wheels of the trolley will be approximately 10″ diameter, 2½″ face, bronze bushed, running on steel shafts carried in solid cast iron bearings. The frame of the trolley will have steel wearing strips, one on each side.

13. SHEAVES:

The sheaves at the head of the towers will be approximately 30″ in diameter, bronze bushed, counterbored, and fitted with large oil cup. The block will have a forged frame of flat steel and will be attached to the steel work of tower by means of forged links with suitable attachments for fastening to the tower.

The sheaves at outer end of the booms will be approximately 23″ in diameter, bronze bushed, with shaft carried in solid cast iron bearings, attached to the main members of the boom. The sheave will be canted so as to bring the hauling cable in the center of the trolley and, at the same time, have the return cable to the engine clear the hoisting ropes of shovel. Malleable iron rope guards will be furnished for both parts of the trolley cable. The sheaves at inner end of booms will be 23″ diameter, bronze bushed, running on a shaft and carried in a forged frame with swinging pivoted connections to the structural work of tower.

14. CABLES AND GUYS:

The hoisting cables will be ¾″ diameter plow steel hoisting cable. The trolley cable will be ⅝″ diameter plow steel hoisting rope. The boom guys will be ¾″ diameter galvanized wire rope, attached to suitable forgings on the boom; each guy will be equipped with a 1″ turnbuckle. The guys at the upper end will be attached to a steel swivel casting with shaft and bearings, securely attached to the structural work of tower. The side guys for the boom will be ¾″ Manila rope

with blocks of approved make, so arranged that the boom can be swung to either side as may be desired.

15. Coal Crusher:

The coal crushers will be of the single roll, swinging crushing block type. The roll will be approximately 24″ diameter, 30″ long, made in sections, securely bolted together and provided with key to prevent turning on the shaft. The teeth will be of the non-clogging type so arranged that the teeth will free themselves, even when working in sticky, damp coal. The diameter of the roll shaft will be approximately 4″, running in babbitted bearings, cast solid with the frame.

A 220 V. D. C. motor of design and make satisfactory to the Engineer is to be installed for driving the crusher. The crushing of the coal will take place between the single roll and the swinging crushing block. This block will be 2″ thick, heavily ribbed and cross ribbed with a renewable face 2″ thick. Crushing block will be pivoted on a 2¾″ shaft, to be held to its work by cast iron weights hanging on the outer arms of malleable iron brackets. The face of the rolls, teeth and crushing blocks will be chilled. The gears for driving the crushers are to be approximately 5″ face, 2″ pitch. The frame of the crusher is to be made of cast iron very heavy section, securely bolted together and made in sections so that it can be removed without dismantling the machine or taking it from foundation. The bed plate of the crusher is to be of ample thickness, cast in one piece. All bearings will be cast solid with the bed plates and bearings will be furnished with removable and adjustable caps.

16. Ash Conveyor:

The Contractor will furnish and install in the coal and ash structure one line of ash conveyor of the overlapping gravity bucket type. This conveyor will be fed from a hopper at approximately the ground level and will discharge into the ash pocket through a movable dumping block. The conveyor will

rise to the upper level of the ash pocket through the towers at the ends of the coal and ash structure and will be provided with the necessary dumping mechanism, takeups, drivers, guides, stops and other auxiliaries and in all the details of its design shall be an exact duplicate of the coal conveyors herein described, except that the ash conveyor buckets will be of the best quality malleable iron 24" wide by about 24" long.

A moveable dumping carriage or tripper will be provided, consisting of the conveyor dumping cams, mounted in the carriage, together with the endless chain, idler, sprocket and operating hand wheels, their shafts and bearings, and the tightener mechanism for taking up the slack in the endless chain, and to be so arranged that it can be readily moved along the trackway provided for the same. Two automatic stops will be provided to prevent the conveyor from running backwards in case the current is cut off when the conveyor is fully loaded.

17. Rail Stands, Guards, Brackets and Rails:

The lower and upper lines of the conveyor will be supported upon cast iron rail stands, spaced about six feet centers and equipped with the necessary cast and wrought iron clips and bolts for securing the conveyor trackways to the same.

There will be provided along the lower line of the conveyor 3-16" steel curved cover plates or chain guards bolted to the track stands, for preventing ashes from coming in contact with the moving parts of the conveyor chain. The cast iron rail brackets will be of the best quality gray iron castings, fitted with the necessary cast and wrought iron clips and bolts for attaching the T-rail, forming the trackway for the vertical risers and curves of the conveyor, to the brackets. Bolts will be provided for attaching these brackets to the structural work forming the support for the trackway of the conveyor. The trackway for the upper and lower horizontal lines, the vertical risers and the curves of the conveyor, also the trackway for the movable dumping carriage, will consist of 16 lb. T-rail

Illinois Steel Company's section, fitted with the necessary fish plates and bolts for the rail joints. The curved portions of the trackway to be bent to conform to the proper radius and requirements. Four rails will be provided for each of the vertical risers of the conveyor, properly tied and braced to prevent spreading or wrecking of the conveyor, should the chain part.

18. CABLE RAILWAYS:

The Contractor will furnish and install two endless rope cable railway systems designed to take coal from the hoppers at the top of the coal and ash structure and deliver it into the various bunkers in the power station. These cable railways will be complete in every particular and must be designed to handle the coal with the least expenditure of labor, and to that end the grips, trippers and other auxiliary machinery must be as nearly automatic as possible. The Company will furnish the steel supports, bridge and housings but the Contractor is to furnish ties, rails and all other machinery and fastenings.

19. TRACK TIES, SHEAVES, IDLERS AND DRIVERS:

The trackway for the cable road will consist of 25 lb. T-rail with fish plates and bolts. Ties to be 4″ x 6″ Y. P. properly spaced and bolted to steel structure. Guard rails of wood or metal will be furnished and installed on the bridge and curves and inside guard rails where required for safe operation.

The straight line idlers will be about 7½″ diameter 6″ face, with steel shafts running in babbitted bearings with cast iron frames, properly spaced to keep the cable clear of ties or steel supports. One special oiling idler with oil reservoir will be furnished for keeping each haulage cable in proper condition. The curves will be equipped with continuous sets of idlers about 9½″ in diameter over all, with cast guard rail to prevent the grip from striking the idlers when rounding the curves. The take up sheaves will be 40″ diameter, scored for

⅝″ cable, with babbitted cast iron bearings and frame complete.

The loading sheaves are to be 36″ and 40″ diameter, with steel shafts pressed in, running in babbitted cast iron bearings. Sheaves to be furnished complete with frames. All necessary grease cups and oiling devices will be furnished.

The driver will be of the two drum type, drum 40″ diameter scored for ⅝″ rope. The drivers will be furnished with all shafts, bearings, pinions and reduction gearings and equalizers together with suitable frames, oiling devices, and holding down bolts. Suitable devices to be furnished for reducing the wear on the cable. The electric motor for driving the cable road will be of 220 volt direct current type, of ample horse power to operate the road when loaded to its fullest capacity and of a make satisfactory to the Engineer.

20. Cable Cars, Cable and Valves:

The cable cars will be of three (3) ton capacity, eight wheel, swivel grip, radial running gear, made of best quality of hard wood, thoroughly painted before assembling, lined with steel plate and equipped with springs, brakes and all refinements of manufacture. Seven cars will be furnished for upper cable road and four (4) for cable road in boiler house. The haulage cable will be ⅝″ diameter, cast steel, seven wires to the strand. The valves which control the discharge of coal from the hopper into the cable cars will be two in number, of the double cut-off type, 16″ x 16″ opening. The valves to be equipped with operating levers and handles, and to have flanges so that they can be readily attached to the hopper; two similar valves are to be provided for the hopper between the upper and lower cable roads.

21. Track Scale:

The track scale for weighing the loaded cable road cars will be of five tons' capacity, of the Howe Scale Company's

manufacture, with platform 4′ wide, 10′ long; scale to be provided with suitable beam box for enclosing the weighing beam.

22. Ash Track, Cars and Locomotives:

The trackway will consist of made up track, with 40-lb. rail and 4″ channel ties spaced about 2′ centers; gauge of track, 24″. Switches will be of the made up type, with tongues and levers for operating. The track layout is shown on drawing No. 14414.

The ash cars—eight in number—will be of a special design, discharging at one side only. These cars will have four wheels, and will be fitted with couplings for attachment to each other and to the electric locomotive. They will be of extra strong, all steel construction, with extra heavy frames, of one-half ton capacity. The electric locomotive will be of the eight wheel type, equipped with storage battery and motors of design satisfactory to the Engineer. All machinery will be properly encased and the locomotive so designed that it can operate under ash chutes from which water is constantly leaking. The locomotive will be amply powerful to haul a total load, including locomotive, of 14,000 lbs. at about two miles per hour up a 3 per cent. grade. The weight of the locomotive will be at least 10,000 lbs.

23. Painting:

All metal work supplied with this contract will be painted at the shops of the Contractor with two coats of red lead and oil. The wire cables will be treated with oil properly applied, and the woodwork of the cars will be primed with white lead and linseed oil and then painted with two coats of approved paint. After erection, the booms and such other structural steel work furnished by the Contractor will be painted with one additional coat of red lead and oil. All painting is to be properly done in dry weather and under cover, care being exercised to secure a perfect job.

29. GUARANTEE:

The Contractor is to furnish and install a coal and ash handling system which will be complete in every respect. He is to guarantee the materials and workmanship of the installation as being first-class in every respect and suited to the work for which they are intended. He is to guarantee that the system will handle steam sizes of anthracite coal from boats alongside, at a normal rate of 200 tons per hour continuously and at a maximum rate of 300 tons, for short periods of time.

He is to guarantee that the ash conveyor will handle wet ashes at the normal rate of 50 tons per hour and at the maximum rate of from 60 to 70 tons per hour for short periods.

SPECIFICATIONS

Accompanied by Drawings for

ONE ELECTRIC TRAVELLING CRANE

for the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. Being a part of contract dated February 25, 1905, between Manning, Maxwell & Moore, Contractors, and The New York Edison Company.

TYPE:

The Crane is of the type manufactured by the Shaw Electric Crane Company.

CAPACITY:

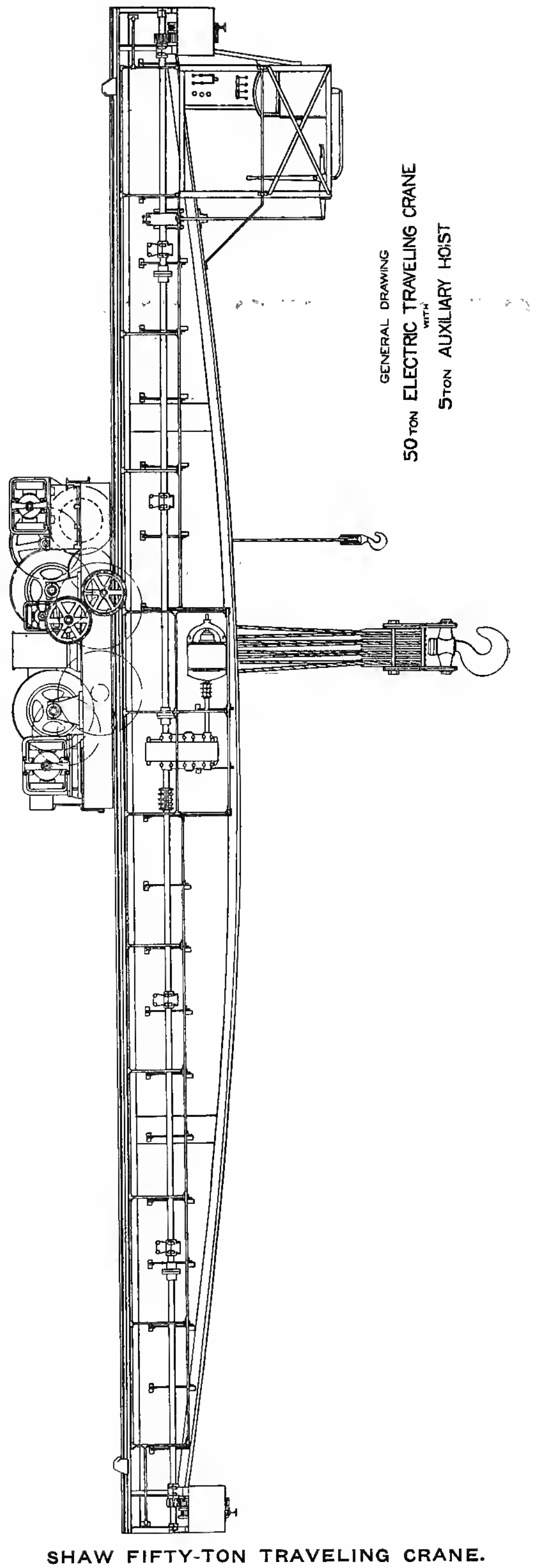
Main hoist 50 net tons. Test load 60 net tons. Aux. hoist 5 net tons. Test load 7½ net tons.

SPAN:

Centre to centre of runway rails 53 feet 3 inches.

HOIST:

Vertical movement of main block 82 feet 3 inches. Approximate maximum speeds in feet per minute:



SHAW FIFTY-TON TRAVELING CRANE.

MOTORS:

	Hoist. Main.	Hoist. Aux.	Trolley.	Bridge.
Full load	12	50	100	100
No load	30	120	125	150
H. P. of motors.....	65	22	7½	22
Speed, r. p. m........	450	350	480	350

VOLTAGE:

Line voltage at crane 220 volts direct current.

MAIN WIRES:

Main line wires, anchors and carriers included for a length of run not exceeding 300 feet.

BRIDGE WHEELS:

Number of wheels used 8, diameter 24 inches.

RUNWAY RAIL:

A. S. C. E. standard 70 lb. rail recommended.

ROPE AND SHEAVES:

	Dia. rope.	No. parts.	Pitch dia. sheaves.
Main hoist	1⅛″	8	30″
Aux. hoist	¾″	2	..

DRAWINGS:

Outside dimensions and extreme positions of hook as per accompanying drawing, 3-G-969.

SPECIAL FEATURES.

GENERAL SPECIFICATION:

The attached General Specification, except as noted below, constitutes part of this contract.

GUARANTEE:

It is guaranteed that the crane will be constructed of suitable materials in a substantial and workmanlike manner; also that it will handle the regular service load continuously at the highest speed given for such load, without dangerous heating of the motors and other electrical apparatus; and that the speeds of the various movements shall be readily controllable up to the limits specified. The Contractor will agree to furnish without charge, new parts to replace any which shall prove defective in material or workmanship within one year from date of putting this crane in operation.

BRIDGE:

The bridge consists of two box girders placed on top of steel truck beams. Chemical and physical properties of material are according to Manufacturers' Standard Specifications for Railway Bridge Steel. Workmanship is of the best quality.

The bridge consists of two girders, securely connected at the ends. Rails are attached centrally on the top flanges and the space between the girders is left clear for hoisting ropes. Girder sections are made such that the stresses set up by the full load and the weight of the crane are not over 12,000 pounds per square inch of net section in tension, or 9,000 pounds per square inch in compression, but the compression, strains are reduced below that figure when necessary to give sufficient rigidity under all working conditions.

When span is not excessive, each flange member is usually of one piece without splice. Web splices are made to give full strength to the section and stiffeners are provided where needed. Diaphragms are provided at frequent intervals. Careful attention is given to rivet spacing.

When head room over runways will permit, the girders are placed on top of structural steel truck beams, and fastened with fitted bolts or rivets; but when head room is limited, a flush construction is to be used in which the girders are butted against the truck beams.

Long and heavy cranes, requiring four wheels under each end, have separate truck beams for each girder. The top flanges of the girders are connected at their ends by wide plates, reinforced by angles. This connection is rigid against racking strains but flexible vertically, allowing the wheels to follow any vertical irregularity or deflection of runway, and distribute the load uniformly on the four wheels.

Bridge Driving Mechanism:

Heavy chilled wheels of special iron are used. Cross shaft is driven near the center. A powerful foot brake is provided. Bridge motor gear and pinion are enclosed.

The crane is carried on heavy chilled wheels made of a special car wheel iron. Treads are ground true and to uniform circumference. The wheels are keyed to long and heavy quills, which are fitted with loose bronze bushings and run on fixed pins, giving most perfect lubrication and exclusion of dirt. Driving gears are keyed to the quills.

Cage and Platform:

The cage is large and convenient. Controllers are usually placed in rear. A platform extends full length of crane and is provided with hand rail.

The operator's cage is constructed of steel angles and is supported at one end of the crane, below and at one side of the bridge. The controllers are placed behind the operator and do not obstruct his view. Only the operating levers are in front of him. A ladder reaching the platform gives easy access to bridge driving mechanism and trolley, facilitating proper care of motors and machinery.

Trolley:

Trolleys are heavy and substantial. Special attention is given to accessibility.

Trolleys have structural steel frames and two hoisting drums. Two types are made. Type A has the hoist motor and

brakes in the center, making a short trolley and giving close approach of the hook to both runways. Type H has the load girt and upper sheaves placed high, giving the greatest possible height of hoist. The motor and brakes being at one end, somewhat lengthens the trolley and limits the approach of the hook to one runway. Either type A or H is furnished, depending upon whether the greatest possible amount of trolley travel or of hoist is desired.

Drums are grooved to take the full run of rope without overlapping, without injurious side pull from the grooves and to give vertical hoist. Grooves are cut from solid metal.

All frames are made strong and rigid, so that bearings will remain in line.

AUXILIARY HOIST:

Auxiliary hoists are provided when required on cranes of ten tons capacity and larger.

LIMIT SWITCH:

Each hoist has an automatic limit switch, which prevents over-travel of the lower block in hoisting.

LOAD BRAKE:

Each hoist is provided with a load brake, which is applied by the weight of the load and released by the rotation of motor in lowering direction. The friction surfaces run in an oil tight casing, securing constant lubrication and freedom from dirt. The friction bands, for operating the pawls, surround the hub of the casing, excluding dirt.

MOTOR BRAKE:

Each hoist is provided with a motor brake, which is released by the current which operates the motor and is applied by gravity when the current is interrupted. It is carried on the trolley frame and not attached to the motor.

Lower Blocks and Ropes:

All hooks are forged from tough refined iron. Sheaves are of large diameter. Rope is special and extra flexible.

All hooks of 15 tons capacity and over, swivel on ball bearings. Sheaves have deep grooves and are well guarded to protect them from accidental injury and to keep the rope in place. Grooves are turned. Diameters are much larger than specified by rope makers, ensuring durability of the rope.

We use a special rope, having 37 wires to the strand, part plow steel and part crucible steel, making it extra strong and very flexible. A factor of safety of about eight is provided in the rope.

Gears:

The drum gears and their mating pinions have cast teeth, of a form to give great strength; all other gears are cut from solid blanks. Pinions are of steel forgings. All gears have wide faces and sufficient strength to stand the overloads to which they are subjected by suddenly starting, stopping and reversing the motors.

Bearings:

Capped bearings are provided as far as possible for all shafts. All capped bearings are babbitted with a good quality of babbitt metal. All wheels and sheaves running on fixed pins are fitted with loose-bronze bushings.

Factor of Safety:

A factor of safety of five will be provided in all parts, the fibre stresses of which are not specified.

Motors:

Motors are of the Shaw make. Speeds are slow, shafts large and mechanical construction simple and strong. Insulation is perfect and workmanship first-class. Coils are machine formed and interchangeable and armatures are easily remov-

able. Designs are right for crane work. Capacities given are mechanical horsepower not electrical horse power.

We recommend open type motors, but furnish enclosed motors when so specified. Our enclosed motors have large doors, which fully expose brush holders and commutator. Armatures, brush holders, field coils and frames are the same as open motors. One type can be converted to the other at any time by providing new yokes. All sizes have four poles. Field frames are soft steel. Yokes are heavy and rigid.

The armatures are wound with machine formed coils, any one of which can be removed and replaced without destroying other coils. The coils are thoroughly insulated from one another and from the core. Commutators are large and of the best construction.

Brush holders are of the loose carbon type. No current is carried through springs. In operation, they are perfect and in convenience of inspection and renewal of brushes they have no equal.

The motors are designed to stand the hard, rough work peculiar to crane service. They can be reversed suddenly under full load and run with 50 per cent. overload without flashing or injurious sparking at commutators.

All motors are given a test in our shop with full load.

Controllers:

All electrical parts are removable from front and top without moving the controller from its position in the cage. A strong magnetic blowout works over the whole range of contacts. All brushes and the blowout coil are carried on a single piece of insulating material. There are no external electrical parts. There are no gears or cams through which power is transmitted.

Our type S controller has been designed to meet the severest requirements of crane service. We use a special resistance material, which has a practically constant co-efficient of resistance regardless of variations of temperature. It is so arranged as to provide good ventilation and is doubly insu-

lated from the case. Any resistance card can be taken out through the door in front of the case by unbolting the electrical connections.

The blowout coil is carried with the brushes, making a short and powerful magnetic circuit and concentrating the magnetic lines at each point where the electric circuit is broken. The block carrying the blowout coil and all brushes can be removed by loosening two bolts and can be as quickly replaced. Contact strips are renewable.

As no electric parts are exposed, the danger of accidental contact with "live" points is entirely removed.

The controller is operated by a forward and backward movement of a long lever, standing in a vertical position and swinging through a small angle, a movement much to be preferred over a short arm, swinging around either a vertical or horizontal axis. As the motion is not transmitted through gears or cams, which cause friction and lost motion, the movement is positive and very easy.

Other Electrical Apparatus:

Wires for moving contacts are of hard drawn bare copper; other wires are rubber covered and thoroughly protected.

Rolling contacts are provided for taking current from main conducting wires to the crane and from bridge cross wires to the trolley.

A slate switchboard in the cage is fitted with main switch, fuses and ground detector lamps.

Electrical Test:

All electrical work, including motors and controllers, is tested with an alternating current of 1,500 volts.

SPECIFICATIONS

Accompanied by Drawings for

ONE ELECTRIC TRAVELLING CRANE

for the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. Being part of contract dated November 23, 1905, between the Case Manufacturing Company, Contractors, and The New York Edison Company.

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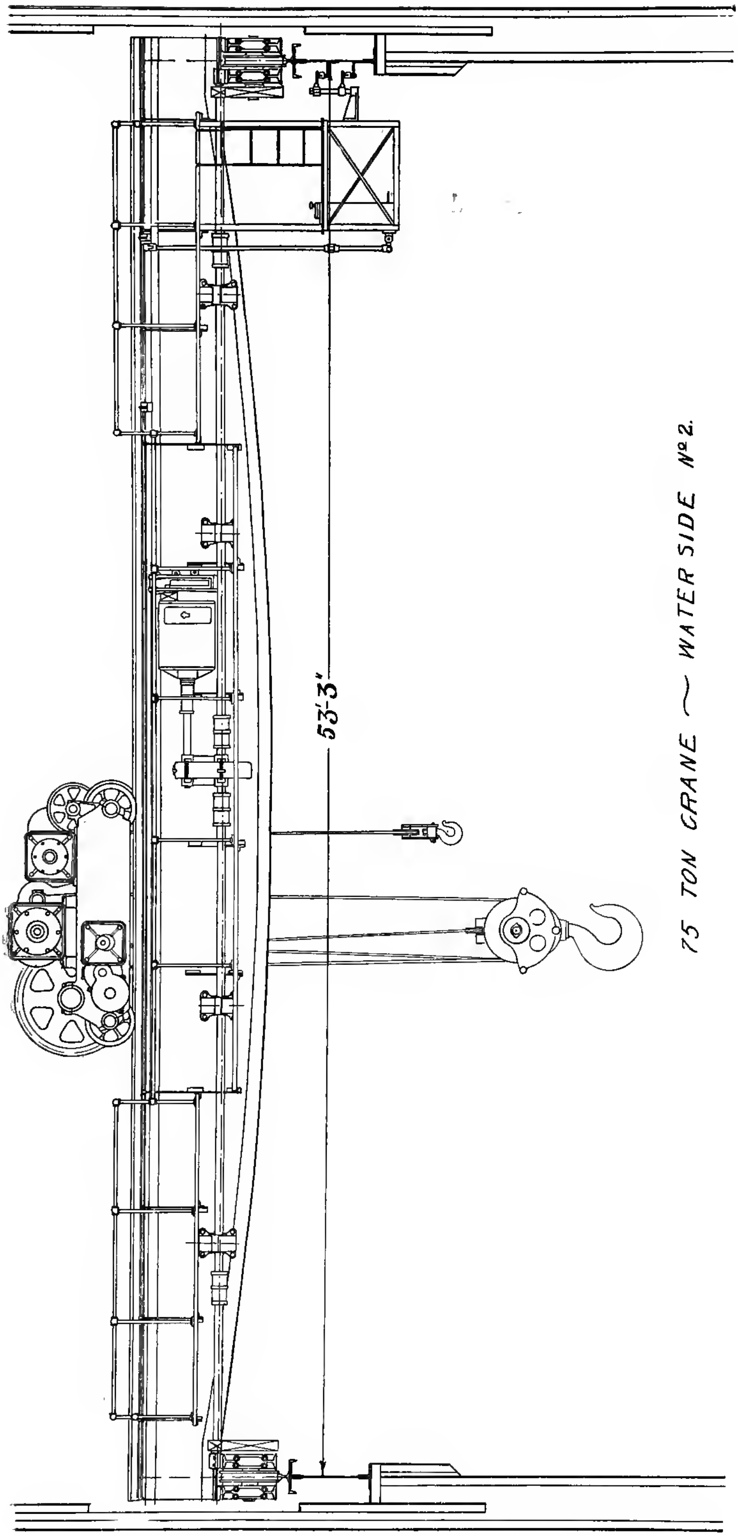
1. Factor of Safety:

This crane will be proportioned so that the factor of safety will not be less than five when the crane is operated to its full capacity, based on the ultimate strength of the material used.

2. Material:

The girders and miscellaneous structural material will be made of medium steel, to conform with the specifications adopted by the Association of American Steel Manufacturers. Except where chilled iron is specified, all iron castings will be of tough gray metal, free from injurious coal shuts or blow holes, true to pattern, and of a workmanlike finish. Steel castings will be of tough metal, having an ultimate strength and



CASE SEVENTY-FIVE-TON TRAVELING CRANE.

chemical analysis best adapted to their requirements. Shafting bearing metals and other materials not specified will be strictly first-class.

3. GIRDERS:

The girders will be made up of plate and angle sections so designed that the maximum load will not produce a strain to exceed one-fifth of the ultimate strength on the lower flange, while the upper flange is sufficient to withstand its compression and the lateral strain due to the sudden starting and stopping of the bridge under full load. The web will be stiffened by diaphragms, which extend the full depth of the girders between the webs and abutt on the under side of the flange plates, the cover plates will be continuous and the web plates shall not be spliced nearer than 15 feet either way from the centre line.

4. END TRUCKS:

The end trucks will consist of I beam sections, with suitable castings to hold the bronze bearing boxes, all properly and securely bolted or riveted together. The double flange truck wheels will be of cast iron, with chilled treads finished to diameter and keyed to the axles. The end trucks will be held by special swivel castings of cast steel, securely bolted to the bottom flange plates of the girders, with reamed and turned bolts. The two girders will be held in place by a proper distance piece of built up section securely riveted and bolted to the ends of the girders.

5. BRIDGE DRIVE:

The bridge motor will be located near the operator's cage and its armature shaft will extend to the center of the girder where the motor pinion engages the main drive gear, thus equalizing the torsion in the longitudinal or squaring shaft. The gears will be cut from solid blanks. The motor pinion and main drive gear will be enclosed in an oil-tight gear case.

6. TROLLEY:

The trolley will be of the single drum type, with side frames of cast iron. The drums will be machine-turned and grooved right and left, with ample size to take the full amount of cable without over lapping. All gears will be machine cut from the solid blank and the pinions machine cut from the forged steel blank. All high speed gears will be enclosed in oil gear cases. The trolley will be provided with a steel cross girt rigidly connecting the side frames and providing a support for the upper cable block so located that the load is equally distributed on the track wheels. The hoisting blocks will be composed of bronze bushed, machine turned sheaves of suitably large diameter, properly connected to the cross-head. The hoisting rope will be of the best quality wire rope with a sufficient number of parts to safely handle the load with a factor of safety of at least 5. Sufficient rope and drums are to be provided in order that the hook of both the main and auxiliary hoists may come within five feet of the engine room basement floor as shown in the attached blueprint No. 14,537.

The steel hook will swivel readily on the ball bearings between the hardened steel plates. The trolley truck wheels will be of the same type as those specified for the bridge truck wheels. The crane will be equipped with the General Electric Company's motors of the dust-proof series reversible type, provided with ring oiling bearings and specially wound for the crane service. The mechanical and electrical parts will be perfectly balanced and only the best of material used in their construction. The motors will stand 1,500 volts alternating current as a protective test and will stand fifty per cent. overload without sparking appreciably.

7. CONTROLLERS:

Each motor will be provided with an independent controller of ample size and capacity to completely control its operation. The controllers will have close regulation and absolute control of the motor. On the brake, the circuits will be

in a strong magnetic field reducing arcing to a minimum. The contacts will be of ample size, interchangeable, and will be readily replaced. The resistances will be of the ventilated type mounted in separate frame from the controller.

8. Limit Switches:

Each hoisting mechanism will be provided with an automatic circuit breaker, limiting the upward travel of the hoisting block and preventing over travel of the hook.

9. Operator's Cage Platform:

The operator's cage will be located beneath and outside the end of one girder; the actual location of this cage will be given later. A foot-way will be provided the entire length of the bridge, furnished with hand railing, for inspection of the tracks, trolley, motors, etc.

10. Bridge Brake:

A foot brake will be provided of the proper strength to effectually control the crane on the run-ways. This brake will be arranged to operate from the cage and will be independent of all electrical apparatus.

11. Electrical Brake:

The armature shaft of the hoisting motors will be provided with an electric brake operated through the medium of a solenoid magnet, connected in such a manner that should the supply of current fail from any cause, the brake is immediately applied preventing the dropping of the load.

12. Mechanical Brake:

The main and auxiliary hoists will be supplied with an entirely independent mechanical brake, in addition to the electrical brake described above. This brake will be arranged so

as to absolutely prevent the load from lowering, unless the motor is revolved by power in the lowering direction.

13. RUN-WAYS:

The longitudinal run-ways and rails will be furnished and erected by the Company, as shown on the Company's drawing No. 14,537.

14. CONDUCTORS:

Two conductors for supplying current to the crane will be provided by the Company, of the dimensions and within the location as shown on the Company's drawing.

15. ELECTRICAL EQUIPMENT:

The crane will be equipped throughout with all the necessary switches, cut-outs, fuse boxes, circuit breakers and wires, all of ample size, fitted up and arranged in strictly first-class manner and thoroughly installed. Suitable contact shoe for taking the current from the rails provided by the Company, will be furnished by the Contractor.

TABLE OF DIMENSIONS, SIZES, AND SPEEDS.

Capacity, maximum work load, main hoist.........	75 tons
Aux. "	5
Span, center to center of run-way rails............	53′ 3″
Lift, maximum lift of main hook................	85′
" " " Aux. "	85′
Height of crane from top of run-way rails, about...	10′ 3″
Crane bridge projects at each end beyond center of run-way rails	106′ ½″
	Per minute.
Approximate speeds under full load, bridge travel....	225 ft.
Main hoist	10 ft.
Trolley travel	100 ft.
Auxiliary hoist	50 ft.

All of the above speeds increase with decrease of load.

Size of motor bridge	50-H. P.
Main hoist	75-H. P.
Trolley	15-H. P.
Aux. hoist	30-H. P.

All electrical equipment will be proportioned for an electro-motive force of 250 volts direct current.

Size of run-way rails, 80 pounds, American Society of Civil Engineers' standard.

Detailed drawings shall be submitted to the Mechanical Engineer for his approval before commencing work.

SPECIFICATIONS

Accompanied by drawings for the

BOILERS AND SUPERHEATERS

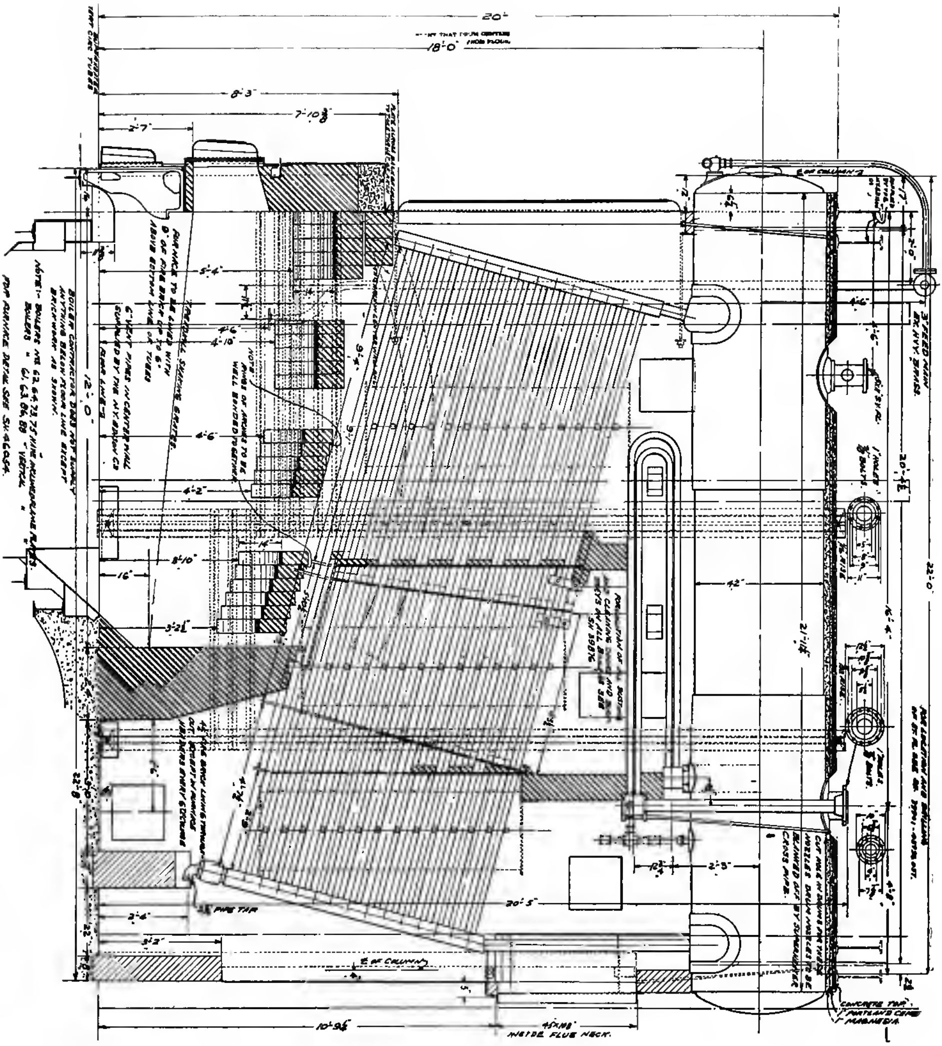
of the New Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of Contract dated December 30, 1903, between the Babcock & Wilcox Company, Contractors, and The New York Edison Company.

DESCRIPTION:

Each boiler shall be composed of twenty-one sections or slabs, each section to be composed of fourteen best lap-welded charcoal iron boiler tubes made from the best knobbled hammered charcoal iron blooms, each tube to be four inches diameter and eighteen feet long, connected at the ends by continuous staggered headers or uptakes and downtakes, and fastened therein by being expanded into bored holes.

Each header to be formed of open hearth steel plate forged to shape and provided with handholes placed opposite the end of each tube, of sufficient size to permit the cleaning, removal and renewal of a tube through the same. Each handhole will be provided with a forged steel cap fastened with wrought iron bolt, safety clamp and cap nut, all joints being made tight, metal to metal.



CROSS SECTION BABCOCK & WILCOX BOILER.

The several sections to be connected at each end to three 42″ steam and water drums and at one end to a mud drum, by means of lap-welded wrought iron tubes four inches diameter and of suitable length, expanded into bored holes.

The three steam and water drums shall be 42″ diameter and 22 feet long, connected to the back headers by vertical back circulating tubes, and to be made of open hearth steel 9-16″ thick. The longitudinal seams of the drums to be butt strapped, seams strapped inside and out, secured by six rows of rivets; circular seams to be double riveted. All holes for longitudinal seams to be punched 3-16″ smaller than the diameter of the rivets to be used and drilled out to full size after the sheets are rolled and assembled with their butt straps. After drilling, the straps are to be removed, all burrs cleaned off and the plates assembled, metal to metal, with parallel turned bolts fitting the holes before rivetting. The transverse or roundabout seams will be punched to diameter of the rivets to be used.

All rivetting to be done by hydraulic presses and the rivets held until black. The heads will be of open hearth steel plate ⅝″ thick, hydraulic flanged. The front and rear heads will be provided with manholes fitted with wrought steel manhole plates and guards.

Each drum will be fitted with a steam valve nozzle, 5½″ opening with 12½″ flange and safety valve nozzle, 5″ opening with 11″ flange, faced in a lathe and of a design to be agreed upon.

The crossboxes for connecting the sections to the drums shall be hydraulic forgings, formed of open hearth steel plate ⅝″ thick.

To each drum will be fitted a steel spool piece having a 5½″ opening with 12½″ flange, faced true and having fine-tool finished seat raised 1-32″, flange to be drilled with 10″ bolt circle eight 1″ holes straddling center lines.

Mud drums will be of steel 149 inches long, each to be provided with three handholes and two nozzles for blow-off pipe, 2½″ opening. The location and bolting of the blow-off

nozzles to be in accordance with drawings to be approved by the Company.

The mud drum handhole plates to be faced and held in position by handhole bolts and nuts.

Each boiler to be supported from wrought iron beams of the building and left free to expand or contract entirely independent of and without affecting the brickwork and so arranged that the removal or repair of any portion of the brick setting may be done without in any way disturbing or moving the boiler or connections. The necessary hangers and cast iron beam saddles to be provided by the Company.

Each boiler to be provided with three Consolidated Mfg. Company's nickel seated safety valves 4″ diameter, set to blow at 225 pounds. To the delivery opening of each safety valve will be attached a muffler located not less than four feet above and eighteen inches to one side of the center of the safety valve.

With each boiler will be furnished the following fittings:

One steam gauge with 12½″ dial.

Two stand pipes with glass water gauges, each fitted with independent cleaning pipes and valves and with three patent gauge cocks with lifting handles and each bolted to flanged necks riveted to drumheads. Each drum will be fitted with one combination stop and check valve to be bolted on special bronze pad casting.

All of the above to be connected by extra heavy annealed brass pipe, all pipe to be extra heavy iron pipe sizes, connected with extra strong composition fittings without gaskets. The supply pipe to each drum shall be 2″ in diameter. The main feed supply pipe starting at a point about four feet above the floor at one side of the battery to pass up over the battery and down the side of the second boiler to a point about four feet above the floor line. In this piping between the two boilers shall be located a 3″ Eaton, Cole & Burnham, Chapman or Best, extra heavy bronze gate valve. The 2″ supply pipe from each drum to be connected to 3″ pipe above referred to.

To each boiler will be attached one stop valve ¾″ diameter. for attaching dusting pipe connections.

The fronts of the boilers to be of ornamental pattern, containing large doors necessary for access to ends of the tubes. Tube doors to be supported from building structure or from angles to be furnished by Contractor. All parts will be ample in strength with joints fitted.

No lower half firing fronts, no grates and no bearing bars will be furnished by the Contractor.

The fixtures of each boiler will consist of flame bridge plates with bolts and special fire brick for lining the flame bridges, bridge wall girders and bars, binders and bolts. Regular style of cleaning doors will be furnished and located to suit the plan of steam piping. There will be four buckstays for each battery.

With each boiler will be furnished a regular damper frame without damper or damper fittings. The requisite lintels will be furnished for all openings in walls, necessary anchor bolts for fronts, and wrought iron doors and frames for obtaining access to the rear of boiler.

With each battery will be furnished one steel wrench fitting manhole nuts, one tube scraper with handle, one set of fire tools consisting of poker, slice bar and hoe, also a hose and pipe for blowing dust from exterior of the tubes.

With each boiler will be furnished a Babcock & Wilcox patent superheater guaranteed to superheat the steam 100 to 125 degrees above the temperature due to the pressure carried. Each superheater will consist of seamless steel U-shaped tubes expanded into forged steel distributing and collecting headers. The ends of the tubes will be readily accessible to handholes, all parts conveniently located for inspection and repair. Proper dusting doors and cleanout doors will be provided and set to give ready access to superheater chambers.

All pressure parts to be tested and made tight under hydrostatic pressure before leaving shop, as follows:

Sections, 400 pounds; drums, 325 pounds; mud drums, 325 pounds.

When erected complete on foundation, the whole structure to be tested and made tight at 325 pounds.

All material and workmanship to be first-class in every particular.

All castings used in the pressure parts shall be sound, free from sponginess, pitting and porosity and from shrinkage and other cracks. Castings of any metal designed as pressure parts and shown by water test to be unsound, porous or spongy will be rejected and not be caulked, peened nor plugged in any way.

All boiler tubes will be made of the best knobbled, hammered charcoal iron blooms of standard weight.

The boilers specified to carry 225 pounds working pressure if desired.

In the brickwork to be provided by the Contractor, first quality brick only will be used. The fire bricks are under no circumstances to be wet, but will be dipped in fire clay batter and laid by rubbing down to place in order to completely fill the joints, making them as thin as possible.

All red bricks will be first quality hard burned, without cracks and with true surfaces. No bats nor bulged brick will be used in any part of the setting. In laying up the walls, every fifth course will be headers, the walls will be true to line and in every respect a first-class job. No joints to be thicker than 5-16". The red bricks will be laid in mortar composed of one part Portland cement, two parts lime and three parts sand.

At each side of each furnace, a fire brick arch will be provided.

The flame plates will be held in position by cast iron retaining bars built into the walls. The back corner of the hanging bridge wall to be completely protected by a cast iron girder not less than 10 inches deep, or other approved construction.

All work to be subject to the approval of the Company.

It is understood that this agreement covers a design of setting as follows:

CENTER WALLS:

Center walls are to be 32″ thick, with a 6″ air space and within the following limits are to be laid only with fire brick.

From 12″ below the top of the grate at every point to 12″ above the highest point of the lower row of tubes, and in the length from the boiler front to 18″ back of the front face of the bridge wall. Outside of the above limits, the center walls will be laid with a core of red brick with a face of fire brick at no point less than 4½″ thick through the whole center wall. Through and through headers are to be laid every other course. In the stretcher course back to the outside bricks, the bricks must be laid transversely so as to lap each outside header brick of the course above and below by at least 4 inches. No broken brick whatsoever are to be used in the construction of either the center or the side walls.

SIDE WALLS:

Side walls are to be laid 17¼″ to 17½″ thick and in no place within the furnace dimensions as indicated under the subheading "center walls" are they to have less than 9″ of fire-buck lining. Outside of the above dimensions, the least lining may be 4½″ thick, the lining of the side wall through out the boiler must be laid with headers every other course and at the fifth course, these headers must be through and through headers, tying the outside red brick of the wall to the firebrick lining. No broken brick are to be used in the side walls.

FIRE CLAY:

Fireclay for joints to be worked as thin as possible, the bricks to be brought to as close a joint as possible with each other. The mortar for red brick is to be made of one third cement and two thirds lime mortar.

REAR WALL:

There is to be no brick work in the rear wall, except such as may be required above and at the side of the damper frame. The back of the setting below the damper frame is to be made up of the wrought iron plates and doors in the usual manner. All outside walls are to be faced with first quality white enamel brick. The firing fronts to be lined in the usual manner and fire brick arches to be supplied for the firing doors.

The boilers to be set with 8′- 3″ furnaces, that is, the bottom ends of the front headers shall be 8′-3″ above floor line.

It is understood that proper supports on foundations for masonry work of the boilers below a point 3 inches below the floor line will be furnished by the Company and that no special brickwork between the side and middle walls of the furnace incidental to the type of stoker or furnace adopted by the Company is included in this contract. It is agreed that should any variation be made from the method of setting above specified, the compensation or deduction therefore shall be made on the basis of cost to the Contractor of twenty dollars per thousand for red brick laid, forty-five dollars per thousand for fire brick laid and seventy-five dollars per thousand for second quality enameled brick laid.

GUARANTEE:

The Contractor guarantees that each boiler, under normal evaporating conditions, will generate 22,000 pounds of steam per hour from and at 212 degrees Fahr. at its best evaporative efficiency and will be capable of being forced to give a steam capacity at least 50% in excess of the normal, and that when any of the boilers equipped with superheaters is operated under the above conditions, the steam will be superheated not less than 100 to 125 degrees above the temperature due to the pressure carried.

SPECIFICATIONS

Accompanied by drawings for the

BOILER FIRING FRONTS

of the New Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of a contract dated February 15, 1906, between the Babcock and Wilcox Company, Contractors, and The New York Edison Company

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DESCRIPTION.

BOILER FIRING FRONTS:

There are to be seventy-two (72) of these fronts—thirty-six (36) batteries; their design and details being shown on the accompanying prints, which are as follows:

8036	Details of firing doors.
8063	Details of ash pit doors.
12417	Diagram of boiler for both floors.
14245	Details of boiler fronts.
14868	Details of new dead plates for boilers.

Each boiler front is to be divided into three (3) panels, and each panel is to be provided with two (2) doors—the upper one being the firing door, and the lower one, the ash pit door.

These three panels are to be exactly alike and are shown in detail on drawing No. 14245.

Filling in the spaces between the middle panel and the two end panels and overlapping the same are to be two splice plates designated as "middle splice plates." Filling in the spaces between the end panels and the building columns and overlapping the panels are to be two splice plates designated as "end splice plates." These splice plates are detailed on drawing 14245. The panels and splice plates rest on and are grouted in the concrete floor. Holes are to be provided at the top of each panel and splice plate, as shown in the drawing, for bolting the same to the channel-and-angle-iron shelf which is to run from column to column across each boiler. Each "end splice plate" is to have bolted to it, on the inside, as shown on drawing 14245, three (3) clamps, for holding the adjoining panel and the splice plate together; and, for the same purpose and on the same side, each "middle splice plate" is to have four (4) clamps bolted thereto.

The dead plates, chairs and the brackets for supporting the dead plates are shown, in detail, on drawing 14868, which drawing, for the matter of these details, supersedes drawing No. 14345.

The firing doors are shown, in detail, on drawing No. 8036.

The ash pit doors are shown, in detail, on drawing No. 8053.

The channel-and-angle-iron shelf is shown, in detail, on drawing No. 14245.

The clamps are shown, in detail, on drawing No. 14245.

The Contractor is to mark, in a manner to be designated by this Company's Engineer, with individual numbers, each part which is intended to make up a complete front for the boiler on that number.

MATERIAL:

The panels; splice plates; dead plates and their chairs and brackets; firing doors; and ash pit doors, are to be of cast iron, of a tough gray mixture.

The clamps are to be of wrought steel.

All castings are to be free from injurious cold shuts, blow holes or other imperfections.

FINISH:

All castings are to be true to the patterns and all parts of the material herein specified to be furnished by the Contractor, are to conform, in every respect, to the detailed drawings, of which blue prints are submitted herewith.

The firing doors are to be provided with frames; checks; handles; air valves, etc.

All holes are to be drilled, unless otherwise indicated on the drawings.

All material and workmanship are to be subject to the approval of this Company's Engineer.

ERECTION:

This Company will do all of the erecting of the material herein specified to be furnished by the Contractor; but the Contractor is to furnish and supply all of the bolts, nuts, clips, etc., which will be necessary to form parts of the finished structure, or for attaching the same to the structure now in place.

DELIVERY:

All of the material herein specified to be furnished by the Contractor is to be delivered where, and as, hereinbefore specified, or at such point in the immediate vicinity as may be later directed and as per the following schedule:

Between date of contract and June 1, 1906:

Twenty-four (24) fronts for the following numbered boilers, as per drawing No. 12417:

8	10	12	14	16	18	On first floor.
19	21	23	25	27	29	
58	60	62	64	66	68	On second floor.
69	71	73	75	77	79	

Between June 1, 1906 and December 1, 1906:

Twenty-four (24) fronts for the following numbered boilers, as per drawing No. 12417:

32	34	36	38	40	42	On first floor.
43	44	45	46	47	48	
82	84	86	88	90	92	On second floor.
93	94	95	96	97	98	

On demand between December 1, 1906 and June 1, 1907:

Twenty-four (24) fronts for the following numbered boilers, as per drawing 12417:

1	2	3	4	5	6	On first floor.
7	9	11	13	15	17	
51	52	53	54	55	56	On second floor.
57	59	61	63	65	67	

SPECIFICATIONS

Accompanied by drawings for the

BOILER FIRING FRONTS

of the New Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of the contract dated September 26, 1905, between Edwin Burhorn, Contractor, and The New York Edison Company

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A. Drawings:

14245—Detail of boiler fronts.
8036— " " firing doors.
8053— " " ash pit doors.
8052— " " dead plates "A", "B" and "C".

B. Materials and Workmanship:

The fronts are to be made of tough gray cast iron, free from injurious cold shuts, blow holes or other imperfections, are to be true to pattern, having a workmanlike finish and are to conform in every respect to the detailed drawings submitted.

C. Description:

Each boiler front is divided into three (3) panels and each panel is provided with two (2) doors, the top door being the firing door and the lower one the ash pit door. These three panels are exactly alike and are shown in detail on drawing 14245. Six (6) of them are required for each battery (three (3) per boiler). Filling in the spaces between the middle panel and the two end panels and overlapping the same are two splice plates, designated as "middle splice plates". Filling in the space between the end panels and the building columns and overlapping the panels are two splice plates designated as "end splice plates". These splice plates are detailed on drawing 14245. The panels and splice plates rest on and are grouted in the concrete floor. Cored holes are to be provided at the top of each panel and splice plate, as shown in the drawing, for bolting the same to the channel-and-angle iron shelf which runs from column to column on each boiler. Near the bottom and on the inside of each splice plate, a clamp is to be bolted, holding the panels and splice plates together, and for each of the two middle splice plates, two intermediate clamps are to be provided. These clamps are detailed on drawing 14245. To each of the middle splice plates, the brackets supporting the dead plates are to be bolted; those brackets are shown in detail on drawing 14245. The dead plates "A", "B" and "C" are shown on drawing 8052. The plates "A" rest on and are bolted to the brackets. The plates "C" rest on the brickwork. The dead plates "E" rest on the plates "A" and "C". The cast iron firing doors are shown in detail on drawing 8036 and are to be provided complete with frames, checks, handles, air valves, etc. The cast iron ash pit doors are shown in detail on drawing 8053. The channel-and-angle iron shelf is shown in detail on drawing 14245 and is to be bolted to the "tee" iron support of the upper tube doors of the boiler, which "tee" iron is provided by the Company. This structure is not to be bolted to the building columns.

D. MATERIAL LIST:

Fronts for twelve (12) batteries of two (2) boilers each (referred to on the drawings as "sets") are required. A bill of material is given on drawing 14245.

E. ERECTION:

All of the above work is to be erected in a thorough and workmanlike manner and to the satisfaction of the Engineer. All bolts, nuts, clips, etc. forming a part of the structure or necessary to attach the same to the material now in place including the drilling of holes for same are to be provided by the Contractor.

SPECIFICATIONS

Accompanied by Drawings for the

GRATES

of the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of the contract dated September 21, 1905, between Neemes Brothers, Contractors, and The New York Edison Company.

General Description:

Twenty-four sets of combined dumping and shaking grates are to be furnished, each complete with beams, links, levers and all other parts necessary to a complete dumping grate. Each grate will be approximately 12 feet 7 inches wide by 10 feet 0 inches deep, as shown on accompanying blueprint No. 13953, and is to be of proper proportions for burning No. 3 Buckwheat coal, with a forced draft of 2 inches water gauge.

SPECIFICATIONS

Accompanied by Drawings for the

ASH DOWNTAKE GRATES AND FORCED DRAFT MECHANISMS

of the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on East by East River, Borough of Manhattan, City of New York, being a part of the contract dated August 1, 1905, between Edwin Burhorn, Contractor, and The New York Edison Company.

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1. Description:

The Contractor is to furnish the following material as detailed on the above drawings:

All pieces called for in list on drawing No. 12929 except those marked A. B. C. D. and F. all complete as shown. A sufficient amount of hand chain is to be provided for each of the valves "E" to reach to about four feet from the second floor. A device is to be provided at each sprocket wheel to prevent the chain from riding off.

The ash downtake gates, shown on drawing No. 13611; there are to be 48 of each.

The forced draught operating mechanisms is shown on drawing No. 13805 which include the operating mechanisms only,

the damper, shaft, bearings and extensions for attaching mechanism to be furnished by another Contractor.

The smoke damper operating mechanism is shown on drawing No. 12987, the dampers with extension shafts being furnished by another Contractor. The pieces shown rivetted to flues and uptakes are to be drilled for 5/8" rivets.

2. MATERIAL:

All cast iron used shall be of a superior grade of remelted cast iron, to be of even grain, free from sand holes, blow holes, cold shuts and other defects. All castings shall be clean and smooth, especial care being taken to remove all fins and other projections from the inside of the downtakes. Castings are to be delivered in an unpainted condition.

All material must be satisfactory to the Engineer.

Steel may be used in all places where wrought iron is called for on the drawings.

All of the bolts, nuts, clips, washers, supports, anchors or any other material necessary to the complete installation of the apparatus both within itself and where it attaches to other work already installed is to be provided by the Contractor.

3. WORKMANSHIP:

All workmanship is to be first class in every respect. The flanges on all pipes are to be faced absolutely parallel; holes are to be drilled, not cored. Gates and valves are to be faced and drilled in the same manner. All gates and valves of the same size are to be interchangeable, and are to work freely and to the satisfaction of the Engineer.

The operating mechanisms are to be built substantially as shown on the drawing. All workmanship must be satisfactory to the Engineer.

4. Deliveries:

On or before the first day of September, 1905, the following material is to be delivered at the station:

One quarter of the material specified on drawing 12929.

24 Forced draught mechanisms R. H. as per drawing 13805.

24 Forced draught mechanisms L. H. as per drawing 13805.

24 Flue draught mechanisms as per drawing 12987.

1 Uptake operating mechanism as per drawing 12987.

12 Ash gates (20 x 12½) 13611.

12 Ash gates (24 x 24) 13611.

With necessary bolts, nuts, etc.

which is one quarter of the entire material.

On or before the first day of October, 1905, the second quarter,

On or before the first day of November, 1905, the third quarter,

On or before the first day of December, 1905, all of the remaining material, specified herein.

5. Erection:

All of the crection will be done by the Company.

SPECIFICATIONS

Accompanied by drawings for the

FORCED DRAFT APPARATUS

of the New Waterside Power Station

Being a part of the contract dated December 23, 1904, between the B. F. Sturtevant Company, Contractors, and The New York Edison Company.

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1. To be Furnished:

The following apparatus and material:

A—Eight (8) Fans connected to

B—Eight (8) Engines.

C—Four (4) sets of steel plate ducts with dampers and connections.

2. Fans:

For the first and second tiers of boilers, the Contractor will furnish eight (8) high efficiency pressure blowers with full housing, of not less than 3-16″ steel plate, approximately 12′ 0″ high, with no angle corners or bracing less than 2″ x 2½″ x 3-16″ L's.

Each fan is to have a blast wheel of the Sirocco type, 70″ diameter by 3′ 0″ in width at the periphery.

For the first tier of boilers, the Contractor will erect four (4) of these fans, as shown on drawing, No. 12512, in the Boiler House Basement, on the concrete foundations.

For the second tier of boilers, the Contractor will erect four (4) of these fans, as shown on drawing No. 12462, under the second floor on a steel and concrete platform.

3. ENGINES:

The Contractor is to furnish eight (8) engines as per the following specifications, erecting them, directly connected to the fans.

TYPE:

To be Sturtevant, 7½" and 13" x 6½" double-acting, vertical, compound, fully enclosed, arranged for direct connection to the fans.

RATING:

To be 65 H. P., based on 290 r. p. m., with an initial steam pressure of 175 lbs. at the throttle, cutting off at 45% stroke in the high pressure cylinder.

DIMENSIONS:

Diameter of cylinder, 7½" and 13".
Length of stroke of piston, 6½".
Diameter of shaft, 3 15-16".
Diameter and length of main bearings, 3 15-16" x 6" (3).
Diameter and length of crank pin 4" x 4½".
Diameter and length of cross head pin, 2⅝" x 3½".
Size of cross head, 5" x 9".
Diameter of steam pipe, 2½".
Diameter of exhaust pipe, 3½".

CYLINDERS:

To be of close-grained cast iron, drilled and tapped for indicators, drains, etc., equipped with lubricators made by the Sight Feed Oil Pump Company.

Valves:

High and low pressure valves will be of the piston type.

Frame:

The reciprocating parts of the engine are to be enclosed by a substantial cast iron frame having doors at the front for access to the connecting rod and main bearings. The upper part of frame is to be separated from the under part by a horizontal partition, keeping the water drip from the stuffing boxes of the piston rod from the oil in the frame body.

The frame is to act as a receptacle for oil which is to be used as a system of splash lubrication. All doors and ends of bearings are to be made absolutely tight, preventing any oil from oozing through from the inner side of the casing.

Reciprocating Parts:

All of which are to be made of the very best quality of forged steel. All bearings are to be lined with the best grade of white metal, hammered and bored. Wrist pins are to be lined with the best Navy composition. The cross head slides are to be lined with white metal; the cross heads being of cast steel. The workmanship and materials throughout are to be of the very best grade and thoroughly adapted to the various requirements for which the engines are to be used.

Holding Down Bolts:

To be provided by the Contractor.

Crank Shaft:

To be of forged steel, forged in one piece.

Governor:

To be a throttling governor and satisfactory to the Engineer. Each engine is to be provided with a cast iron drip pan with drain pipe connection down to floor.

4. DUCTS:

The Contractor will furnish four (4) sets of steel ducts as per drawing No. 11611. The material used in these ducts is to be in no case less than 3-16″ thick and in the connections between the ducts and the ash pit, in no case less than ⅛″ thick. A sufficient amount of angle and tee iron bracing is to be installed to make the ducts rigid, and all joints so made are to be absolutely air tight.

In each duct, the Contractor is to install three dampers, one at the center and one at the outlet of each fan. These dampers are to be of approved design and are to be equipped with some satisfactory operating device.

In each duct, the Contractor is to provide six connections to boilers but the Company will furnish the necessary dampers and mechanisms for same.

All duct work is to receive two coats of paint when completed, which paint is to be approved by the Engineer.

A sufficient number of manholes are to be provided in each of the four ducts to allow easy access to any part of same.

5. GUARANTEES:

The Contractor agrees that each of the above units, when operated at a speed of approximately 290 r. p. m. will deliver 90,000 cubic feet of air per minute, measured at the fan outlet, and that, while delivering this amount of air, will maintain, in the ash pits of the boilers to which it is connected, a pressure equal to 2″ of water, with a normally thick fire of small anthracite coal on the grate.

6. ERECTION:

The Company will provide all the necessary foundations to receive the above apparatus; they will also do all the necessary cutting away of concrete or removing of pipes or other interferences with apparatus already installed; they will also make all the necessary steam, exhaust and drip connections to the engine.

The Contractor is to erect all of the above specified work,

including the cutting of concrete for the setting of the holding-down bolts for both the fans and the engines, the grouting of the same and the hanging of the steel duct, all in a thorough and workmanlike manner and to the satisfaction of the Engineer.

7. Dates of Completion:

At least four (4) fans with engines and ducts complete ready for use by Sept. 15, 1905, the remaining four by Feb. 1, 1906.

8. In General:

It is further understood that three complete sets of detailed drawings of the fans, engines and the duct construction will be submitted by the Contractor for the approval of the Engineer before starting any of the work.

SPECIFICATIONS

Accompanied by drawings for the

FORCE DRAFT APPARATUS

of the New Waterside Power Station.

Being a part of contract dated February 21, 1907, between the B. F. Sturtevant Company, Contractors, and The New York Edison Company.

GENERAL:

The Contractor hereunder is to furnish the following equipment:

Ten (10) Engines.
Eight (8) Blowers.

ENGINES.

TYPE:

The engines are to be of the single, vertical, simple, double-acting, enclosed type arranged for direct connection to the blowers.

RATING:

They are to be of 65 horse power on a basis of 290 r.p.m. and with a pressure per square inch, at the throttle, of 120 pounds of saturated steam; and shall also operate satisfactorily in every respect with a pressure per square inch, at the throttle, of 200 pounds of steam with 100 degrees, Fahrenheit, of superheat.

CYLINDERS:

The cylinders are to be of the best grade of hard, close-grained charcoal iron; fitted with liners of similar material which will wear smooth and be satisfactorily durable. The liners shall be bored true and smooth and be counter bored, and shall be of such thickness that after removal of 3-16 of an inch by reboring, the fibre stress will not exceed 2,000 pounds per square inch under a steam pressure of 200 pounds per square inch. The cylinders are to be lagged with 85% carbonate of magnesia covered with planished iron jackets.

The cylinder and valve-chest heads are to be carefully fitted to insure proper metallic joints. All stuffing boxes are to have composition bushings. All cylinders are to be drilled and tapped for indicator, relief and drain connections, etc., and equipped with positive sight-feed lubricators.

VALVES:

The valves are to be of cast iron, of the piston type, and without packing rings. They are to operate in removable bushings with milled ports, and of first quality, hard, charcoal iron; these bushings being forced into place and held by screws.

PISTONS AND PISTON RODS:

The pistons are to be of cast iron and of light though rigid design, recessed for the ring on the piston rod and fitted with cast iron "Ramsbottom" packing rings.

The piston rods are to be of the best crucible, forged steel,

carefully ground to size. They are to be securely fastened to the pistons by a taper fit and nut, and to the crossheads by a screw thread and jamb nut. A ring is to be forged on the rod to form a shoulder for the piston.

Crossheads and Guides:

The crossheads are to be cast steel, carefully annealed, and shall have ample means for adjustment. The wearing surfaces are to be exceptionally large and faced with genuine "Babbitt" metal, and provided with an approved method of lubrication.

The wrist pins are to be of the best nickel steel; they shall be accurately ground to size, flattened on opposite sides, and located mid-length of the shoe-bearings. They shall be accurately fitted into the crossheads with taper fits and securely held in each case by a key and nut.

The guides are to be of the bored type, easily removable from the frame when desired, and shall be of hard, close-grained cast iron.

Connecting, Valve, and Eccentric Rods:

These are to be of the very best crucible, forged steel.

The connecting rods are to be of the marine type and carefully designed as to lightness and strength. The crank-pin boxes are to be of the best cast steel carefully annealed, lined with genuine "Babbitt" metal thoroughly peened, and then bored to gauge. Adjustment is to be provided for by through bolts with locknuts and cotter-pins—suitable liners being included.

The cross-head ends are to be of the marine type with bronze or steel boxes, babbitted and adjusted by liners and bolts,

The valve-rods shall be carefully ground to size. The eccentric rods are to be fitted with bronze bushings forced into place, bored and reamed to a proper fit, for the reception of the eccentric rod pins which are to be of the best nickel steel and carefully ground to size.

CRANK-SHAFTS:

The crank-shafts are to be of the best crucible steel, each forged in one piece, turned true, ground to size, polished, and fitted with proper annealed cast-steel counterweights securely fastened in place by bolts and dowels.

Special care shall be given to the fitting of the shafts to their bearings.

Each shaft is to be provided with oil-deflecting rings forged directly thereon to prevent the oil from flowing out of the ends of the bearings.

Each shaft shall be provided with keyways for the eccentrics and the flywheel, and with an approved coupling on the driving end.

FLY-WHEELS:

The flywheels shall be accurately turned and balanced, have an odd number of arms and be of the very best quality of cast iron.

ECCENTRICS:

The eccentrics and their straps are to be of the best quality of cast-steel. The straps shall be lined with "Babbitt" metal and provided with an approved method of lubrication.

MAIN BEARINGS:

The main bearings are to be exceptionally large and fitted with removable shells lined with genuine "Babbitt" metal carefully peened in place, and bored accurately to gauge.

Provision for adjustment for wear shall be made by means of liners.

These boxes are to be so designed as to be readily removable for examination or re-babbitting by simply relieving them of the weight of the shaft.

Frames and Beds:

The frames are to be of a design giving ample strength and rigidity, and allowing entire accessibility of the working parts for their removal; all of such parts being completely enclosed, all doors and bearings being oil-tight. Each crank-case is to have removable covers on the ends, and doors at the front and back for access to the interior thereof. The upper part of the frame is to be separated from the under part by a horizontal partition, keeping the drip of the cylinder and valve chest stuffing-boxes from the oil in the frame body. A suitable sub-base is to be provided for each engine frame; the surface of its joint therewith, and the bottom of the engine frame being planed for a proper bearing.

A drip-pan is to be furnished having a pipe leading to a reservoir provided with a visible gauge showing the amount of fluid therein.

The frames, sub-bases and drip-pans are to be of a good quality of cast iron.

Governor:

An approved throttling governor is to be provided.

General:

With each engine there shall be provided a throttle valve of approved design, the necessary relief valves, complete indicator connections and rigging, an approved sight-feed oil pump for cylinder oil, a complete general oiling system and the required foundation bolts with their anchor plates, nuts and washers.

The "Forced System" of lubrication is to be used; the oil being brought to the engine under a pressure of 30 pounds provided by the Company.

All wearing surfaces are to have accurate and simple means for adjustment, which, so far as possible, shall be so arranged that the wear and consequent adjustment will not disturb the alignment of the working parts nor alter the steam distribution.

All flat wearing surfaces are to be scraped by hand to surface-plates.

All exposed nuts and cap bolts subject to frequent removal shall be finished and case-hardened.

All machine work throughout is to be made to gauge and shall be interchangeable; and skilled inspectors will subject each part to careful inspection at each stage of manufacture.

All stuffing boxes are to be provided with metallic packing of an approved type.

All exterior finished parts of each engine shall be polished, and all exterior surfaces of castings shall, before shipment, be filled, rubbed and painted in a neat, workmanlike and approved manner.

It is the intention under this specification to obtain an engine that will operate, under fire-room conditions, continuously for twenty-four hours per day and six days per week, under a pressure of 200 pounds of steam, with 100 degrees, Fahrenheit, of superheat, without undue wear or heating. To this end all bearing and wearing surfaces are to be extra large; the oiling arrangement adequate; all shafts, rods, pins, keys, and bolts and other parts of the best material, and fitted for the service herein specified; and all workmanship of the highest quality.

The engines are to be high grade in every particular; neat and attractive in design; scientifically proportioned in all respects; and satisfactory in every way to the Mechanical Engineer of the Company.

GUARANTEE:

The Contractor hereunder guarantees that each engine will operate without undue wear of any of its parts and practically without noise and perceptible vibration, and that he will furnish or replace any part which, within one year of operation, proves to have been defective in design, material or workmanship.

FANS.

TYPE:

The blowers are to be of the full-housed, pressure, steel plate type, with "Sirocco" wheels.

CAPACITY:

Their capacity shall be the delivery of 90,000 cubic feet of air per minute, at approximately 300 r. p. m. under conditions as hereinafter specified.

GENERAL:

The casings of these blowers are to be at least 3-16 of an inch thick and well braced with angle sections in no place smaller than 2" x 2½" x 5-16".

Two of these blowers are to have angular, top discharge—one right-hand and one left-hand; and six are to have horizontal top discharge—three right-hand and three left-hand. All are to have single inlet.

Each blower shall have two bearings, and the inboard end of the shaft shall be of proper length and fit and turned to receive a suitable coupling for the driving engine.

Each blower shall be provided with a swing or pivoted damper, with operating lever and locking device, within the casing and so designed as to prevent a back flow of air from the duct when the blower is not in operation. All material and workmanship are to be subject to the approval of the Company's Mechanical Engineer.

GUARANTEE:

The Contractor is to agree that each blower will be of high efficiency, and that when operated at the before stated approximate speed it will deliver the hereinbefore called for quantity of air per minute measured at the blower outlet; and that with two units, each delivering this amount of air into opposite ends of a

duct having a cross sectional area of thirty square feet, and an approximate length of one hundred feet, and with six ash pit connections—nine feet by nine inches—from the top of the duct, there will be maintained in the ash pits to which they are connected a pressure equal to 2″ of water, with normally thick fires of small anthracite coal on the grates. He is to further guarantee that the Company will be protected against loss or damage through defective material or workmanship for the term of one year from the date of its acceptance of the equipment.

SPECIFICATIONS

Accompanied by drawings for the

ECONOMIZERS

of the New Waterside Power Station.

Being a part of the contract dated March 13, 1907 between the B. F. Sturtevant Company, Con tractors, and The New York Edison Company.

GENERAL DESCRIPTION OF THE WORK.

There are to be eight (8) "Sturtevant" Standard Fuel Economizers; installed as four units, in connection with twenty Babcock & Wilcox boilers of 650 B. H. P. each, and for a service of twenty-four (24) hours per day. Two of the economizer units are to be installed in connection with 5200 B. H. P. (2600 B. H. P. each), and the other two economizer units in connection with 7800 B. H. P. (3900 B. H. P. each).

The four economizers for the lower floor of the boiler house are to consist, each, of 336 pipes in 56 sections of 6 pipes per section; the four for the upper floor are to consist, each of 312 pipes in 52 sections of 6 pipes per section; the total number of pipes for the four units being 2,592.

The pipes of the several sections of each economizer shall be so arranged that those of any one section will stand centrally

opposite the spaces between those of the adjoining section; thus staggering their location.

The length of each economizer for the lower floor shall be 36′-3″; the length for each economizer for the upper floor shall be 33′-10″. The width between walls for each group, throughout, shall be 10′-0″. The height of all sections shall be 10′-2¼″ and the height, overall, of each complete unit 12′-6″ on 1st floor and 15′-1¾″ on 2nd floor.

The total heating surface to be installed under these specifications is to be 32,308 square feet, and the aggregate capacity of the four units in feed water to be heated, 163,296 pounds per hour. The length of all economizer pipes shall be 9′-0″; their outside diameter 4-9/16″; and the thickness of their walls ⅜″. They shall be cast on end in dry sand moulds.

All economizer pipes are to be connected to the top and bottom headers by taper, iron-to-iron joints without packing or cement; each pipe being seated separately from the top, thus allowing its withdrawal and replacement without disturbance of any other pipe.

The caps over the tops of the pipes are to have taper ground seats; they are to be seated from the inside, without through bolts or packing.

The several sections shall be connected at the top by lateral side joints and secured by heavy outside bolts; each joint to be independent of any other. At one end of the bottom headers the several sections shall be connected to the wall boxes, or manifolds, by means of taper ground seats and outside bolts; which latter are also to secure, opposite each bottom header, hand hole plates having taper, ground seats.

The wall box, or manifold, for connecting several bottom headers shall be made up of one length, or more, as the number of sections may require; each two adjoining lengths to be connected by means of a "U" bend, providing for expansion and contraction. Each economizer shall be provided with a proper, approved and efficient scraper-mechanism with lifter rods and guide plates; the scrapers to be operated by a suitable pulley motion and positive reversing gear.

Each economizer is to be provided with the following named accessories:

One 2″ Relief valve;

One 2½″ blow-off valve;

One Water-inlet connection;

One Water-outlet connection;

The necessary "U" bends for the wall box;

The necessary cast iron, and properly fitted, doors and frames for the soot pit;

The bed plates for the top of the foundation walls;

An asbestos covering for the top of the economizer.

In addition to the foregoing, the Contractor shall also provide for the complete economizer installation herein specified, 124 heat non-conducting covers for the fronts of the economizers; and 20 special side dampers, or baffle plates, for the space between the backs of the economizers of each unit, together with the necessary steel cover-plates for this space.

Each section of each economizer shall be subjected by, and at the expense of, the Contractor, in the presence of a representative of the Company, to a shop hydrostatic test of three hundred fifty (350 pounds per square inch), and which test is to be satisfactory to the representative. After its erection each complete economizer is to be tested to 200 pounds hydrostatic pressure per square inch and proven to be water-tight in all its joints.

Each economizer is to safely withstand a working pressure of 200 pounds per square inch, and the relief valve shall be set to operate at that pressure.

All materials to be used in the construction of the herein specified economizers shall be of the best of their various kinds; all workmanship shall be first-class in every particular; and both materials and workmanship are to be satisfactory to the Engineer.

The Contractor guarantees to furnish and repair all parts necessary due to defective material or workmanship for one year from the date of the contract to which these specifications are annexed and of which they form a part.

The Contractor is to do the erecting of all of the apparatus

herein specified to be furnished by him; supplying all material and necessary appliances therefor except the foundations; leaving all joints absolutely tight against leakage; and installing complete and satisfactory equipments ready for connections and in accordance with the intent of these specifications and the hereinbefore referred to drawing.

The Contractor shall annually make two inspections of the herein specified economizers; one inspection internal and one inspection external and shall send to the Company a report of each inspection. The Contractor's charge for these inspections shall not exceed for each economizer the sum of Fifty Dollars ($50.00) per annum; and there shall not be any charge made for the inspections during the first two years of installation of the economizers.

The Company is to furnish all materials for, and build, all needed foundations, settings and brickwork for the herein specified economizers and in accordance with the plan or plans therefor which shall be provided by the Contractor; it being understood that the foundation for any given economizer shall be in readiness for its erection at least six weeks prior to the date of completed erection of the latter. The Company will also provide and place all required dampers in the main flues between the uptakes of each boiler in order that the amount of gases from the several boilers can be regulated to suit the respective areas of the economizer units as consistent with the variation of boiler duty; and will further provide and place between the economizer units and the stack the necessary automatically operated dampers for controlling the velocity of the furnace gases as the best operation of the economizers may demand.

SPECIFICATIONS

Accompanied by drawings for the

Turbine Driven Centrifugal Boiler Feed Pumps

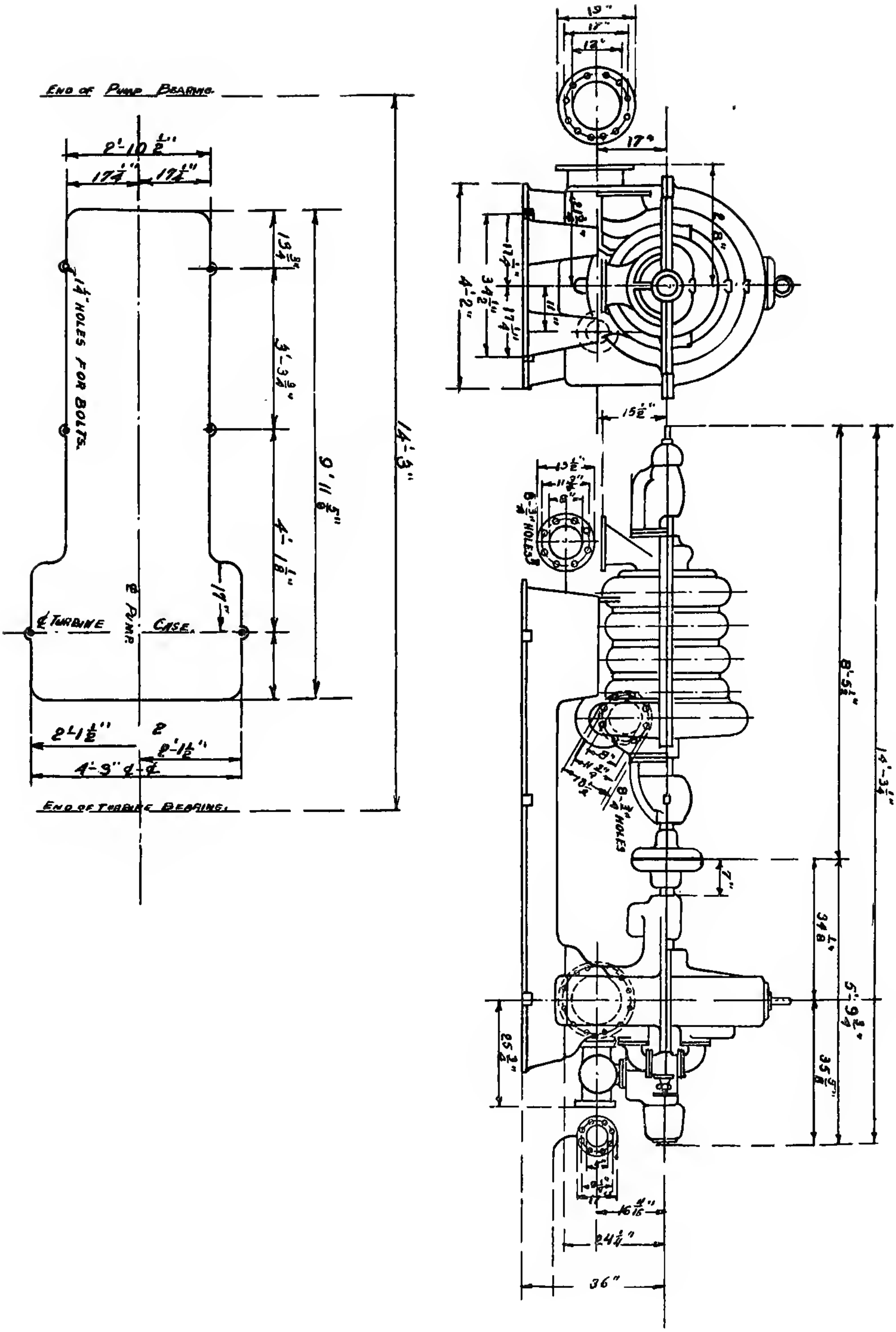
of the New Waterside Power Station.

Being part of the Contract dated May 13, 1907, between the D'Olier Engineering Company, Contractors, and The New York Edison Company.

GENERAL:

Each of the 8 units will consist of an 8" five-stage pump, direct-coupled, by means of flexible coupling, to a steam turbine, both pump and turbine being mounted on a heavy cast-iron baseplate, making the unit self-contained. Each pump will have a rated capacity of 1,000 g. p. m. when operating against a total head of 700 feet, approximately 300 pounds at a normal speed of 1,650 r. p. m. There will also be one 8" check valve for each pump for 300 pounds working pressure.

An approved throttle valve will be furnished with each turbine and the necessary special wrenches will be supplied for both turbines and pumps.



GENERAL DRAWING D'OLIER FEED PUMP AND TERRY TURBINE.

Workmanship Guarantee:

The pumps, turbines and appurtenances are guaranteed against defective workmanship and material for a period of one year from date of shipment, and should any such defect develop within this time a new part will be furnished to replace same, f. o. b. Waterside Station, without charge.

We guarantee the efficiency of the pump end of the unit to be not less than 65% when delivering 1,000 g. p. m. against a total head of 700 feet, when handling water not exceeding 200 degrees Fahr., delivered to the pump suction under a head of not less than 6 feet.

Measurements to be made as follows: The total head shall be measured by a gauge placed close to the suction inlet of the pump, and a gauge placed close to the discharge outlet of the pump, with the necessary correction for the location of the gauges.

PUMPS.

Make:

The pumps will be of the design as furnished by the D'Olier Engineering Company, as set forth more in detail below.

The pumps will be of the single-suction five-stage type, stages being arranged in series between the suction and discharge, the last stage being at the extreme opposite end of the pump with reference to the first stage. The pump case will be horizontally divided through the centre, thus permitting inspection and cleaning of the interior, without disturbing suction or discharge piping, or bearings, or the disturbing of the steam turbine or alignment of turbine or pump.

Capacity:

Capacity—1,000 U. S. gallons fresh water per minute

against a total suction and discharge head of 700 feet (including frictional resistance in piping).

All capacities are based on handling hot water at a temperature not to exceed 200° Fahr., the water being delivered to the pump under a head of not less than 6 ft.

Other capacities with 700 ft. total head are as follows:

1,000	g. p. m.	—	approximately	1,650	r. p. m.
900	"	—	"	1,630	"
800	"	—	"	1,595	"
700	"	—	"	1,575	"
500	"	—	"	1,530	"
300	"	—	"	1,500	"

While the pumps are designed for 300 lbs. working pressure, this pressure may be made much less if desired, by reducing the speed of the turbine and pump more than above indicated, and there will be no difficulty in bringing the speed down to a point to maintain 200 lbs. discharge pressure, or to any point between 200 and 300 lbs. that might be desired. The maximum quantity of water delivered at any given pressure will be maintained at approximately 1,000 g. p. m.

GOVERNING DEVICES:

To maintain a constant discharge pressure with varying quantities of water (automatically), a pressure regulator will be supplied to operate in conjunction with and to be part of the turbine governor for constant speed; or if it is found more advantageous, a separate regulator will be supplied to control the pump unit independently of the turbine constant-speed governor. It is, therefore, contemplated that the pump will be entirely automatic in its operation when maintaining a constant discharge pressure.

BALANCING DEVICE:

The pump will be balanced against end thrust in such a manner that the stuffing box at the discharge end of pump

will be subjected to a pressure slightly above atmospheric. This pressure will be controlled and maintained constant by means of a relief valve, the drain from the relief valve being carried to the pump suction, thus preventing any waste of water.

General Dimensions:

Diam. of suction—8″.
Diam. of discharge—8″.
Rated Speed—1,650 r. p. m.

Impellers:

Impellers to be of the enclosed single-suction type, with backward curved blades, properly proportioned for the duty, and made of bronze.

Guide Vanes:

Guide vanes will be cast solid with the supporting ring with a separate cover ring or side plate, all of bronze, and removable from the pump case. They will be designed with a view of meeting the special conditions required.

Shaft and Sleeves:

Shaft will be of steel, and between the impellers and at the outer ends where it passes through the stuffing boxes, it will be protected by bronze sleeves, which are renewable.

Case:

Case will be made of cast iron, and made in two pieces, divided horizontally through the centre and designed for 300 lbs. working pressure. The upper half of the case may be removed, permitting inspection and cleaning of the interior of pump without disturbing the suction or discharge piping or bearings. The partition walls between stages will not reach

entirely to the shaft, but a bronze partition ring will be inserted between them and the shaft.

PACKING:

Stuffing boxes with gland and take-up studs are provided for fibrous packing.

BEARINGS:

Bearings to be of the self-oiling ring type, ball seated, split and removable, and so arranged that no oil can pass into pump case. In connection with the bearing housings, are cast drip pockets for collecting any drip from the stuffing boxes.

SUCTION AND DISCHARGE:

Suction and discharge openings to be flanged, faced and drilled to the New York Edison Company's standard.

MOUNTING:

Both pump and turbine will be mounted on a one-piece sub-case of cast iron, turbine and pump to be connected by flexible coupling.

STEAM TURBINES.

MAKE:

The turbines will be of the design as manufactured by the Terry Steam Turbine Company as set forth more in detail below:

The turbine will be of the single-wheel Terry type, and of such design that the main portion of the turbine case is subjected only to exhaust pressure.

Steam Conditions:

The turbines are to be designed for 175 lbs. steam pressure at the throttle, and 100° superheat. They will also be designed to operate with 200 lbs. steam pressure, when necessary, and will be capable of delivering full rated power with 170 lbs. gauge pressure saturated steam. The Company is to provide free exhaust connections that the turbine may not be subjected to back pressure.

Capacity:

The rated capacity of each turbine will be 300 brake H. P. when operating at a speed of 1,650 r. p. m. and the steam nozzles or jets are to be designed for steam conditions as named above. In order to secure a less quantity of water than the rated capacity of each pump, the turbine will be so designed that it may be operated at a speed as low as 1,450 r. p. m.; or any speed between 1,450 and the full speed. At the reduced speeds, the turbine shall have sufficient capacity to drive the pump when delivering the lesser quantity of water.

Governing Devices:

A fly-ball type centrifugal governor to be mounted on the main turbine shaft, and will operate in connection with the balanced type of piston valve for maintaining the turbine at a substantially constant speed. This design of governor and valve is subject to any changes that may be found necessary, under subject "Governing Devices" for pump. The governor valve shall be provided with bronze stem working through a gland of brass, and the throat of the stuffing box shall be bushed with brass where it comes in contact with the stem.

Turbine Wheel:

The turbine wheel will be 3 ft. in diameter, and composed of two discs of hard "saw" steel; buckets to be made of rolled steel, dove-tailed into these discs, and securely fastened therein.

Shaft:

Turbine wheel will be mounted on a shaft of hammered steel, which will measure 2⅞" in the bearings.

Bearings:

Bearings to be of the self-oiling ring type, with two oil rings for each bearing; bearings to be split and removable, of cast iron, lined with best babbitt metal, supported at the center only and enclosed by dust-proof felt washers.

Case:

The case will be of cast iron, made in two pieces, divided horizontally through the centre, and so designed that the upper half may be removed, permitting of the inspection of the turbine wheel, without disturbing the steam or exhaust connections. The housings for supporting the main bearings will be cast with the lower half of the case.

Reversing Chambers:

Mounted within the lower half of the case are reversing chambers of cast bronze, machine-smooth and polished. In connection with the bronze reversing chambers, there will be eight nozzles or jets designed for the steam conditions herein called for.

Packing:

The shaft will be provided with stuffing box and suitable packing where it comes through the turbine case.

Pipe Flanges:

The steam and exhaust openings are to be flanged, faced and drilled to the New York Edison Company's standard.

Mounting:

Turbine will be mounted on same sub-base as supplied with the pump, and connected to the pump by means of a flexible coupling.

Steam Consumption:

With 175 lbs. steam pressure and 100° superheat at the throttle, and no back pressure, the Contractor guarantees the turbine to use not to exceed 32 lbs. of steam per Brake H. P. per hour.

SPECIFICATIONS

Accompanied by Drawings for the

TURBINES FOR THE BOILER FEED PUMPS

of the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of contract dated January 2, 1906, between the Terry Steam Turbine Company, Contractors, and The New York Edison Company.

GENERAL DESCRIPTION:

8 Turbines of the Terry type will be furnished of 225 brake horsepower each, and running at a speed of 1,650 revolutions per minute.

ECONOMY:

The Contractor guarantees that with steam at 175 lbs. per square inch pressure and 100° Fahr. of superheat, the turbines will operate on 32 lbs. of steam per brake horsepower per hour.

Failure to obtain this economy may be deemed sufficient cause for the rejection of the apparatus.

The Contractor will guarantee the turbine for a period of one year from date of starting same, against defective design, workmanship or material, and if trouble arises from the above defects, the Contractor agrees to repair same without cost to the Company.

DELIVERY:

Delivery will be F. O. B. cars or boat at Hartford, Conn.

SPECIFICATIONS

Accompanied by drawings for the

FEED PUMPS AND HEATERS

of the New Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of Contract dated January 12, 1906, between The Platt Iron Works Company, Contractors, and The New York Edison Company.

VICTOR TURBINE PUMPS:

Eight (8) No. 6 four stage Victor Turbine Pumps are to be furnished, each pump to have a capacity of 1,000 U. S. gallons of water per minute under a total head of 500 feet.

SPEED:

1650 rev. per minute.

PUMP SHELL:

Pump shell to be of cast iron.

PUMP RUNNER:

Pump runner to be of composition bronze.

Pump Bearings·

Pump bearings to be liberal in size and specially designed and constructed for the work in hand.

Pump Shaft:

Pump shaft to be of hammered iron or forged steel.

Pump Base:

Pump to be provided with cast iron subbase, especially designed and constructed to take care of the steam turbine which will be furnished by another Contractor to drive the pump.

Accessories:

All nuts subject to frequent removal will be cast hardened and all necessary oil cups and lubricators will be provided.

Erection:

Erection to be done by the Company.

FEED WATER HEATERS.

No. of Units:

Four (4) Stilwell heaters will be furnished.

Capacity:

Each 500,000 lbs. water per hour.

Over all Dimensions:

Length 22′-0″; width 6′-0″; height to face of flange on exhaust outlet 11′-4″.

Connections:

Diameter exhaust opening any size up to 30″.
Cold water supply 8″.
Pump suction 16″.
Over flow 8″.

Pans:

Number of tiers of pans, 4.
Number of large pans, 16.
Number of small pans, 16.

Contents:

Total cubical contents about 1,000 cu. ft.
Cubical contents storage chamber, 587 cu. ft.

Shell:

Shell of the heater to be of best grade of cast iron with all joints machined and fitted together with indestructible gaskets to insure entire freedom from leakage; the water inlet pipe to be of brass. There will be one hinged door large enough to permit of easy entrance to all parts of the heater.

Oil Separator:

Heater to be equipped with an efficient oil separator, which shall practically eliminate the oil from the exhaust steam before it comes in contact with the water. The separator is self cleaning and is drained through a drip pipe which should be connected with waste ways and always open.

Overflow:

Overflow is of the water sealed type, placed at the back of heater and arranged with wide opening at the water line, which acts as a skimmer. The water passes through this opening to water seal or traps, which while of ample size is arranged to withstand a pressure corresponding to that carried in the heater. This arrangement effectively seals the opening and prevents the entrance of air into the heater without using a check valve.

Pans:

The pans are to be of cast iron of the inner and outer discharge counter current type, supported on Bridgetree in the upper part of the heating chamber opposite the two rectangular exhaust openings, which admit steam to the heating chamber. The pans are securely held in place in such a manner that they cannot be dislodged by the pulsations of the exhaust, though they can be readily removed through the cleaning door.

Water Supply:

Outside of the heater on the inlet pipe is placed a balanced valve for regulating the cold water supply, which valve is controlled by a ventilated copper float carried in the heater.

Protection of Pump Suction:

The pure water chamber which surrounds the pump suction is separated from the filtering chamber by means of screened plates or gratings, which prevents the filtering material from passing over the pump.

Accessibility:

Every provision is made for examining and cleaning all parts of the heater without disturbing any pipe connection, the openings being of large size and conveniently located. The face or joint of cleaning doors and flanged openings are arranged with special form of bolting (standard bolts slipped into slots). The doors are hinged so that they may be swung to one side and are large enough for a man to enter.

Fittings:

With the heater proper as specified above, there will be furnished the following fittings: ventilated copper float, cold water regulating valve with crank, levers and rods for connecting same to float, Bibbcock, water gauge glass and fitting and all openings for steam or water ready for connection.

Performance:

This heater is sold to perform the following duties provided it is connected and operated in accordance with the instructions of the Contractor.

First:

To deliver water suitable for boiler feed or other purposes; i. e., to give protection against cylinder oil carried in the exhaust steam entering the heater.

Second:

Given a sufficient and continuous supply of exhaust steam, heater will raise the temperature of feed water to 210° or 212° Fahrenheit.

Third:

To give all the purification that can be obtained by heating water to the temperature of exhaust steam by furnishing large depositing, settling and filtering surface and by saving and utilizing the steam condensed in heating the water.

Fourth:

The heater will not cause any back pressure on the steam engine, as the combined area of the steam passageways through it are largely in excess of the area of the exhaust pipe entering it.

Fifth:

To automatically regulate the cold water supply, keeping it down to the amount actually required over and above the condensed exhaust, thus preventing waste of water.

Sixth:

The material used and the workmanship furnished to be first class in every respect; the fittings to be of superior quality and particularly adapted to their work. In general, the heater is guaranteed to be simple and highly efficient and reliable in operation, easily and quickly cleaned and thoroughly well made in every particular.

Erection:

Erection is to be done by the Contractor.

SPECIFICATIONS

Accompanied by drawings for the

8000 Kilowatt Turbo-Generators

of the New Waterside Power Station.

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of the contract dated June 29th, 1905, between the General Electric Company, hereinafter called the Contractor and The New York Edison Company, hereinafter called the Company.

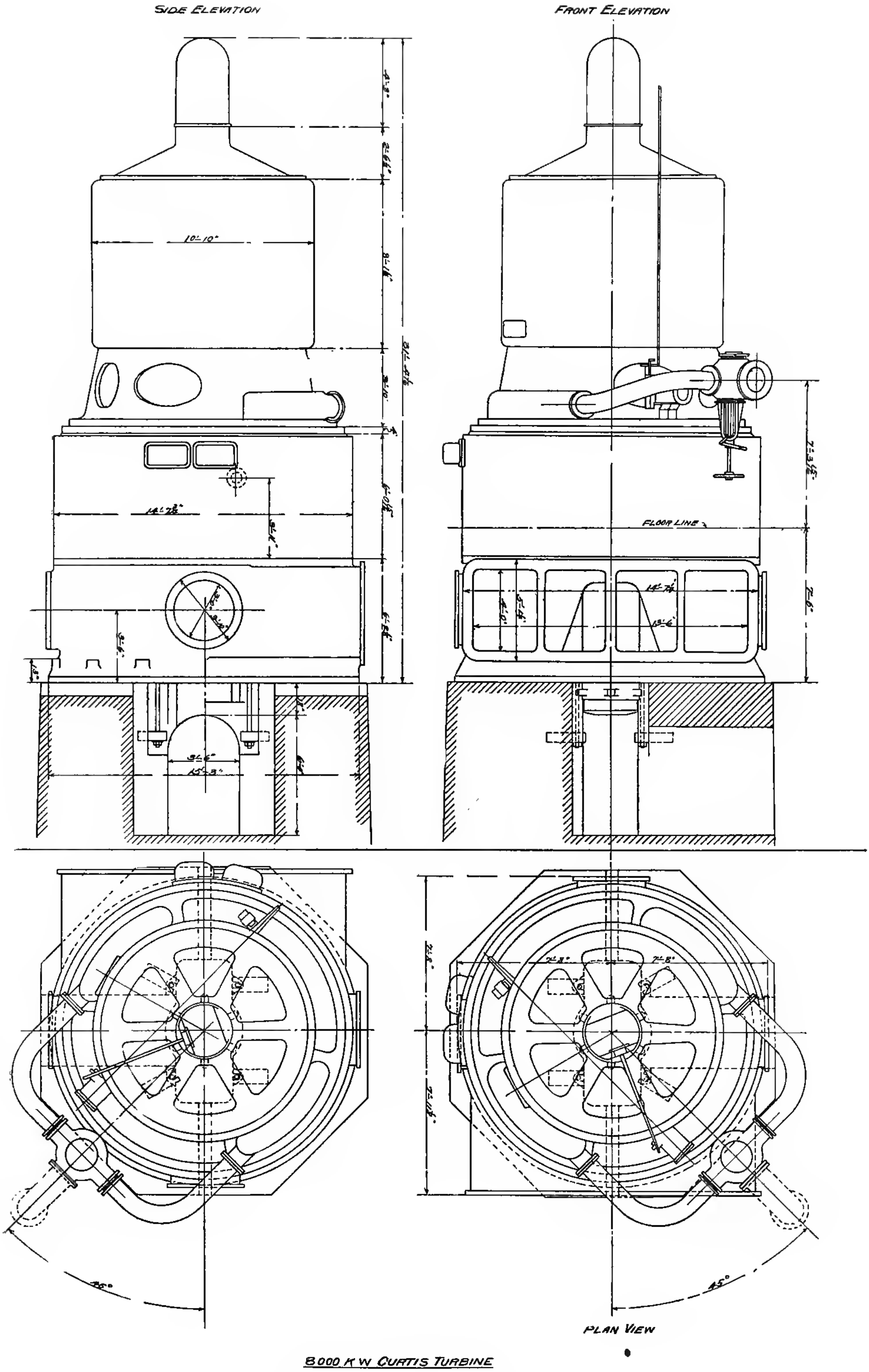
This contract covers two (2) turbine units of 8,000 K. W. capacity each.

The turbines will be of the Curtis type and designed to operate condensing.

GENERATOR:

The generator will be of the four pole A. T. B. type of 8,000 K. W. capacity, and when running at its normal speed, 750 revolutions per minute, will deliver three phase current of 25 cycles per second at a pressure of 6,600 volts, at the rate of 700 amperes per phase.

The Contractor guarantees that the turbine and generator connected therewith will run continuously at its normal rat-



GENERAL DRAWING CURTIS TURBO-GENERATOR.

ing without undue heating, undue noise or vibration. The variation of speed shall not exceed 2% from no load to full load, but sudden variation of load may cause 4% momentary speed variation.

The regulation of the generator or the rise in potential when full non-inductive load is thrown off, the speed and excitation remaining constant, will be 8%.

TEMPERATURE RISE AT 100 PER CENT. POWER FACTOR:

Full load, 24 hours, 40° C.
12½% overload, 24 hours, 45° C.
50% overload, 2 hours, 55° C.

INSULATION TESTS:

Field, 1,500 Volts.
Armature, 13,200 Volts.

MAXIMUM EXCITATION:

Voltage, 125; K. W. 50.

The turbine and generator will not be injured by 75% overload applied momentarily. When making the temperature test, the overload will immediately follow the full load run.

NOISE:

The turbo-generator covered in this contract will make no more noise than the units already installed and on order.

TEMPERATURE TEST:

The temperature rise will be taken by a thermometer and based on a room temperature of 25° C. In the event of the room temperature differing from 25° C., the observed rise in temperature will be corrected ½% for each degree C. that the room temperature differs from 25° C.

The insulation test will be made by applying an alternating current between the windings and the core for one minute.

The excitation specified will be sufficient to excite the machine when operating at 80% power factor and the given overload in current.

DIMENSIONS:

Diameter of base 15 ft. 2 in. Height 32 ft.

APPROXIMATE WEIGHTS:

Net 700,000 lbs. Shipping 775,000 lbs.

FOUNDATIONS:

Foundations with foundation bolts to be furnished by the Company.

INSTALLATION:

The Contractor will furnish all labor necessary for installing the apparatus and a competent man to superintend the erection on foundation, also to start the apparatus and place it in good operative condition. The Contractor agrees that the installation shall be done in a thorough and workmanlike manner.

The Company will provide a crane capable of handling the heaviest piece, oil and operating force, necessary openings in walls, runways, timber, blocking, etc., and will bring steam to the turbine and take exhaust from the exhaust opening.

ACCESSORIES:

This contract includes throttle valve, screen in main steam pipe, steam gauges, vacuum gauges, water pressure gauge, complete set of wrenches, speed regulating governor, emergency stop and a suitable field rheostat for the generator.

This contract does not include steam generating apparatus, condensers, pumps (air, circulating or feed pumps), exciter, switchboard equipment, automatic relief valve connecting tur-

bine to atmospheric exhaust, or piping other than that which is supported by, and forms a part of the turbine structure.

For supplying water to the step bearing, the Contractor will furnish two steam driven pumps, each capable of furnishing 12 gallons of water per minute at 800 lbs. pressure.

For supplying oil to the other bearings, the Contractor will furnish two steam driven pumps each capable of furnishing 3.2 gallons of oil per minute at 35 lbs. pressure.

The Contractor will also furnish in connection with the oil pumps, two suitable tanks, each having a capacity of 85 gallons.

This contract does not cover piping necessary to connect pumps to the water lubricated step bearing or oiling system. Such piping will be furnished by the company. Galleries and platforms attached to the turbine structures will be furnished in accordance with drawings submitted by the Contractor.

GUARANTEE:

The Contractor guarantees the apparatus specified herein to be of the full working capacity as rated and agrees to correct any defects in same which develop under normal and proper use within one year from the starting thereof, provided, the Company gives the Contractor immediate written notice of such defects and provided further that during said period, the apparatus shall not be taxed beyond its normal capacity, shall be regularly cleaned and cared for and in other respects shall be operated in a normal and proper manner.

SPECIFICATIONS

Accompanied by drawings for the

7500 Kilowatt Turbo-Generators

of the New Waterside Power Station.

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, being a part of the contract dated July 6, 1905, between the Westinghouse Machine Company, Contractors, and The New York Edison Company

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GENERAL DESCRIPTION:

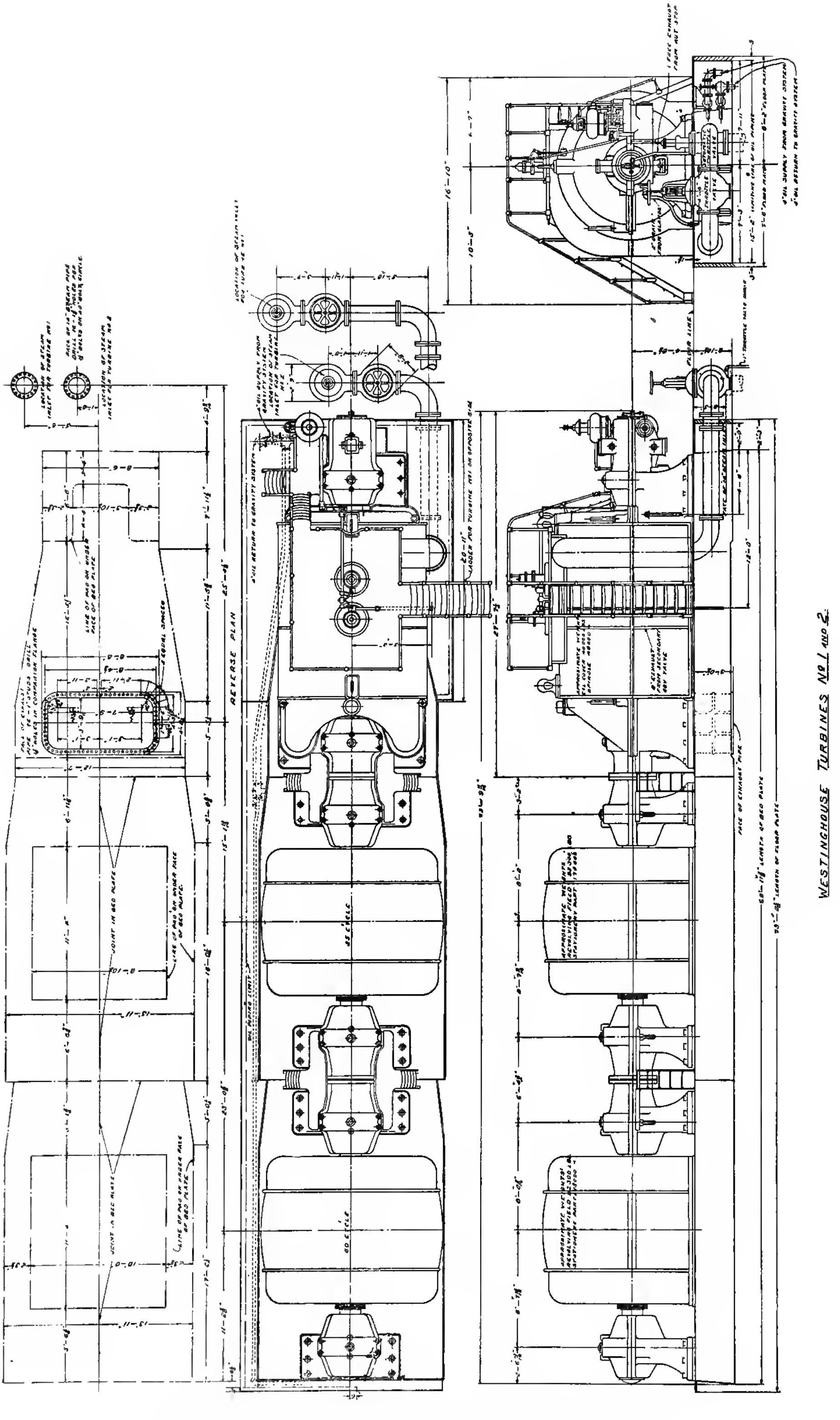
The general design to be in accordance with the outline drawing accompanying these specifications. The turbine to be of the type known as the Multiple Expansion parallel flow and adapted for driving a direct connected generator, running at 750 r. p. m. and giving 3,000 alternations per minute.

The turbine together with the generator to be mounted on a continuous bed plate, provided with suitable supports for turbine, generator, generator bearings, etc.

All revolving parts to be accurately balanced so as to run smoothly and without undue vibration or noise.

MATERIAL AND WORKMANSHIP:

The various materials entering into the construction of the turbine to be of first class quality and in kind conforming to the



GENERAL DRAWING WESTINGHOUSE GENERATOR.

most approved practice as regards each individual part of the machine.

The workmanship to be of high grade character in every detail.

Dimensions and Weights (of Turbine):

Max. length of turbine alone, about	35′-0″
Max. width of turbine, about	17′-0″
Max. height above floor level, about	15′-0″
Total approximate weight of turbine	450,000 lbs.
Approximate weight of heaviest piece	80,000 lbs.
Approximate weight of generator	250,000 lbs.

Dimensions and Weight of Combined Unit:

Maximum length over all, about	50′-0″
Total approximate weight	700,000 lbs.

Capacity:

To develop 7,500 kilowatts when operating at 750 revolutions per minute, with dry saturated steam of 175 lbs. gauge pressure per sq. in. at the throttle and with a pressure in the exhaust pipe of 2 inches of mercury absolute at the turbine exhaust outlet.

The turbine will be capable of operating in an efficient and serviceable manner under all fluctuations of load within its specified capacity and with any quality of steam between saturation and 125 degrees Fahr. superheat.

Parallel Operation:

Having no reciprocating parts, the turning effort being practically uniform during one revolution, and the rotating parts having considerable mass and velocity, the angular speed of the turbine will be substantially constant, insuring the successful operation of alternating current generators in parallel which is hereby guaranteed.

ECONOMY:

The quantities of steam hereinafter given include all steam used or consumed by the turbine and all leakages or losses in the turbine but does not include steam consumed by the auxiliaries.

It is understood that the regular conditions under which these turbines are to operate will be as follows: one hundred seventy-five (175) lbs. steam pressure, two (2) inches of mercury absolute back pressure and one hundred (100) degrees Fahr. of superheat.

The steam consumption will not exceed the following quantities when operating at 750 revolutions per minute; with steam superheated 100 degrees F. above the temperature of saturated steam, measured at the throttle at a pressure of 175 lbs. gauge per sq. in., and with a pressure in the exhaust pipe of 2 inches of mercury absolute:

Full load	(7,500 K. W.)	........15.9	lbs.	steam	per	K. W. H.
¾ load	(5,625 K. W.)	........16.8	"	"	"	"
½ load	(3,750 K. W.)	........18.3	"	"	"	"
1¼ load	(9,375 K. W.)	........16.5	"	"	"	"
1½ load	(11,250 K. W.)	........17.6	"	"	"	"

OVERLOAD:

The turbine is to be provided with a secondary governor valve by means of which 50% overload may be developed, or full load developed when operating without condenser, during which time the turbine will work smoothly and properly and without undue wear.

The valve is to be automatically operated by a suitable mechanism in connection with the governor and arranged to open whenever the load exceeds the amount that the turbine can carry when normally operating. It will similarly operate should the vacuum or steam pressure fall to a point where the turbine is unable to normally carry the load and will automatically return to its seat when the excess capacity of the turbine is no longer required.

CYLINDERS:

To be of close grained cast iron and designed so that the tensile stress shall at no time exceed 2,000 lbs. per square inch. The high pressure sections of the turbine to be so designed that the stresses shall not exceed the above when subjected to a steam pressure of 200 lbs. per square inch.

The low pressure section of the cylinder, where the normal stresses are usually less than the above, to be designed so that the stresses shall not exceed 2,000 lbs. per square inch when subjected to the highest pressure due to operation under the beforementioned overload, or for non-condensing operation.

GLANDS:

Suitable glands or packing to be provided which will effectually prevent leakage where the turbine shaft passes through the ends of the cylinder. These glands to be water sealed, no other oil or lubricant being necessary. No oil used in the turbine will be able to find its way into the cylinder through these glands.

TURBINE BLADES:

To be of suitable material of best mechanical construction and of form and dimensions most conductive to high economy.

MAIN BEARINGS:

To consist of heavy cast iron shells lined with babbitt metal and to have ample surface so as to run cool and without undue wear. The outer surface of the cast steel shells to be spherical, fitting in a corresponding concave seat to permit the self-aligning of the bearings. The bearings to be conveniently adjustable for taking up wear and arranged so that they may be readily taken out of the turbine without first removing the turbine shaft. The turbine bearings will be mounted on extended portions of the turbine cylinder and the generator bearings on massive cast iron pedestals bolted to the bedplate.

BEDPLATE:

A suitable bedplate with planed supports or bearing pads for turbine, generator, etc. is to be provided. To be made of cast iron of box pattern heavily ribbed and of sufficient depth and strength to secure rigidity of the turbine.

SHAFT:

To be of best quality of open hearth steel; to have mounted thereon suitable cast steel rings for carrying the turbine blades, these castings to show the following physical characteristics in a standard test specimen 2 inches long and ½ an inch in diameter.

Tensile strength not less than 65,000 lbs.

Elastic limit not less than 30,000 lbs.

Elongation not less than 15%.

When operating at maximum load, the stresses in the shaft due to combined twisting and bending moments shall not exceed a fibre stress of 8,000 lbs. per square inch.

COUPLING:

A suitable coupling to be provided for connecting the turbine and generator shafts; to be of steel and arranged to be readily disconnected. The stress in this due to maximum load shall not exceed 9,000 lbs. per square inch.

GOVERNOR:

A suitable and sensitive governor to be provided for controlling the speed by varying the admission of steam; to be driven directly from the turbine by means of positive gearing. When the turbine is operating under normal conditions the difference between the speed at friction load and the speed at full load will not exceed 3 per cent. of the average speed, and the governor will be certain and positive in its operation. The variation in speed may be greater than above specified, should the character of the load of the turbine be such as to render desirable a greater variation, such for example as the operation of alternating cur-

ıent generators in parallel. In this case, the governor will be so proportioned that there will be no tendency for the load to surge between one turbine and another with which it may be connected in parallel.

The Company is to signify when accepting these specifications, which regulation will be the more desirable for the particular purpose for which he intends to use the turbine. Means to be provided whereby the tension of the governor spring may be varied in either direction while the turbine is running, without in any way disturbing its operation otherwise than making the desired change. Necessary apparatus on the turbine to be provided to enable the operator to control the distribution of load between turbines from a common point. Connections to such apparatus and central control to be provided by the Company.

LUBRICATION:

The lubrication of all main bearings to be affected by a continuous circulation of oil supplied by a system of delivery and drain pipes, and a suitable oil reservoir located in the bedplate.

A suitable oil pump of simple and durable construction to be furnished and a means of driving same by the turbine. An oil cooling coil to be provided, arranged within suitable water chamber through which the oil will circulate. The water chamber to be provided with suitable water connections. All necessary piping for the above purposes will be attached and fitted to the turbine in a first class workmanlike manner. All oil piping above the floor level and in sight to be of brass or copper with polished brass fittings. The bearing pedestals will be provided with baffle plates which will effectually prevent any leakage of oil.

In addition to the above, will be furnished a full complement of small oil cups for the governor gear, etc. There will be no means by which it will be possible for oil to enter any of the steam chambers of the turbine and thereby come in contact with the exhaust steam.

Throttle Valve:

A suitable throttle valve to be provided, equipped with a small by pass for warming up purposes.

Governor Valve:

The governor valve for controlling the admission of steam to be of the balanced poppet valve type, made of hard cast iron and enclosed within a suitable steam chest. To be operated by the governor by means of suitable mechanism.

Safety Stop:

A quick operating throttle distinct from that referred to on page 249 is to be provided, which in combination with a separate auxiliary governor, will automatically close itself, should the turbine speed exceed the safe limit. Means to be provided for adjusting this governor, whereby the device will act at any predetermined speed. Means also to be provided for operating this safety stop by hand from a point in close proximity to the turbine.

Inspection:

The Company, or its representative is to be at liberty to inspect the work at any reasonable time during the construction.

Lifting Gear, Tools, etc.:

A complete set of wrenches to be furnished to fit all nuts. Also all necessary eye bolts for handling the various parts, as well as suitable lifting yokes and gear for removing the turbine shafts.

Painting:

The work to be of high finish throughout and all parts that are not polished will receive two coats of filler rubbed down smooth and one coat of flat paint before shipment. Any further painting to be done by the Company after erection.

LAGGING:

All cylinders, etc., and surfaces where radiation will occur, to be well and sufficiently lagged so far as may be practicable and expedient. The cylinders are to be covered with steel plate jackets, neatly painted and secured with steel binding strips and corner plates. To be arranged so as to be conveniently removed. No screws having a diameter of less than 3-16 inches to be used in this work.

LIMITS OF TURBINE:

Unless otherwise stated in these specifications or otherwise agreed upon in writing, the turbine builder's work will begin at the inlet valve of the turbine and will end at the exhaust connection provided on the turbine. The company therefore will furnish all steam and exhaust piping outside the above limitations. All steam and exhaust pipes must be arranged so that they cause no stress on the turbine either by their weight or by their expansion, and expansion joints must be provided in these pipes should it be otherwise impracticable to relieve such stresses.

In the interest of both parties to these specifications, it is expedient that the turbine builder have the privilege of examining plans showing the steam and exhaust piping and the arrangement of the condenser. The Company will also provide the necessary piping to bring water for cooling the oil to a valve provided on the turbine, and furnish the piping that forms the overflow for this purpose as called for on the outline drawing accompanying these specifications.

No weight of exhaust pipe other than the expansion joint and no weight of the steam pipe beyond the safety stop shall be borne by the turbine.

TURBO ALTERNATER.

GENERAL DESCRIPTION:

This alternating current generator will have a rotating field and will be of the turbo type. There will be four poles and the

frequency will be 3,000 alternations per minute (25 cycles per second) at a normal speed of 750 revolutions per minute. It will deliver 3 phase current at 6,600 volts.

Generator to be of the enclosed type and to operate without undue noise or vibration; i. e.: The turbo-generator units of similar size and speed or turbo generator units of type and size now in the Waterside Station of The New York Edison Company.

General Construction:

The rotating part will be built of high-grade steel and will be mounted upon a forged steel shaft.

This rotating part will form the field of the machine and will carry the field windings, which will be substantially supported against displacement, vibration and centrifugal force. Means will be provided for dissipating heat generated in the field windings.

The weight of the electrically and magnetically inactive material will be reduced to a minimum in order to decrease the weight on the bearings. The external frame will be designed to allow access to the stationary armature windings.

Material and Workmanship:

To be first class throughout, of a nature best suited to the requirements of the various parts and to be complete and sufficient in every detail.

Normal Full Load Rating:

The normal rating of this generator will be 655 amperes per terminal at 6,600 volts and 100 per cent. power factor. The normal rated output therefore will be 7,500 kilowatts.

Efficiency:

The efficiencies are based on C^2R losses in the armature and field coils and armature iron loss. These losses are determined separately. At the normal rated current and voltage and 100

per cent. power factor, the efficiency will not be less than 95.5 per cent. at one half load; 96.7 per cent. at three quarters load; 97.5 per cent. at full load, and 97.8 per cent. at one and one quarter load.

EXCITATION:

This generator will be separately excited. The field will require approximately 240 amperes at 100 volts when the generator delivers its normal rated current at normal voltage and 100 per cent. power factor. At maximum load, the exciting current will increase to 300 to 350 amperes, depending on the adjustment of the load.

COLLECTOR:

The collector will be of ample size for the maximum current to be carried. The brushes will be of carbon and there will be 6 brushes per collector ring.

ARMATURE:

The armature will be of the slotted drum type. The core will be built of laminated steel of a high magnetic quality. The lamination will be supported by a cast iron frame or yoke and dovetailed accurately thereto. The laminated core thus built up will be held firmly in place between two end plates. The armature winding will consist of cable wound coils, formed and insulated before being placed in the slots. The coils will be held in the slots by overhanging tips of teeth. The insulation of the armature conductors will consist of sheet material of high insulating quality, applied in overlapping layers. This will be held in place with tape and the whole will be treated with a moisture-proof and oil-proof compound. After completion, the insulation of the armature winding from the core will be subjected to a momentary puncture test of 22,000 volts alternating E. M. F.

FIELD:

The field poles will be made of steel. The steel pole pieces and the field winding will be so proportioned as to reduce the

armature reaction and self induction to a low limit. The field coils will be wound with strip copper. The insulation of the field coils from the poles will consist of several layers of fibrous material and will be substantial and permanent. After completion, the insulation of the coils from the poles will be subjected to a momentary puncture test of 1,000 volts alternating E. M. F. Coils to be wound in slots cut in the field core and held in place by brass wedges driven into slots.

REGULATION:

The rise in voltage with full load (100 per cent. Power Factor) thrown off will not exceed 10 per cent. with constant speed and constant excitation.

TEMPERATURE:

The generator will deliver its normal rated current at normal voltage and 100 per cent. power factor for twenty-four hours with a rise in temperature not exceeding 35 degrees Centigrade in any part; at the same voltage and power factor, but a twenty-five per cent. greater current, it will operate for 24 hours with a rise not exceeding 50 degrees Centigrade; at the same voltage and power factor, but a fifty per cent. greater current, it will operate for 3 hours, succeeding full load run with a rise not exceeding 60 degrees Centigrade. Temperature to be measured by a thermometer in accordance with A. I. E. E. rules.

VENTILATION:

Throughout the armature spider, core and windings, large and open ventilating ducts will be provided. The design of the rotating parts will be such as to set up a forced circulation of air through these ventilating spaces. Similar ventilating spaces will be provided in the field coils, so that a free circulation of air may be maintained while the machine is in operation. The end windings of the armature will be so arranged that the air will circulate freely among them, thus keeping the temperature very low.

SPECIFICATIONS

Accompanied by Drawings for

Two Surface Condensing Equipments

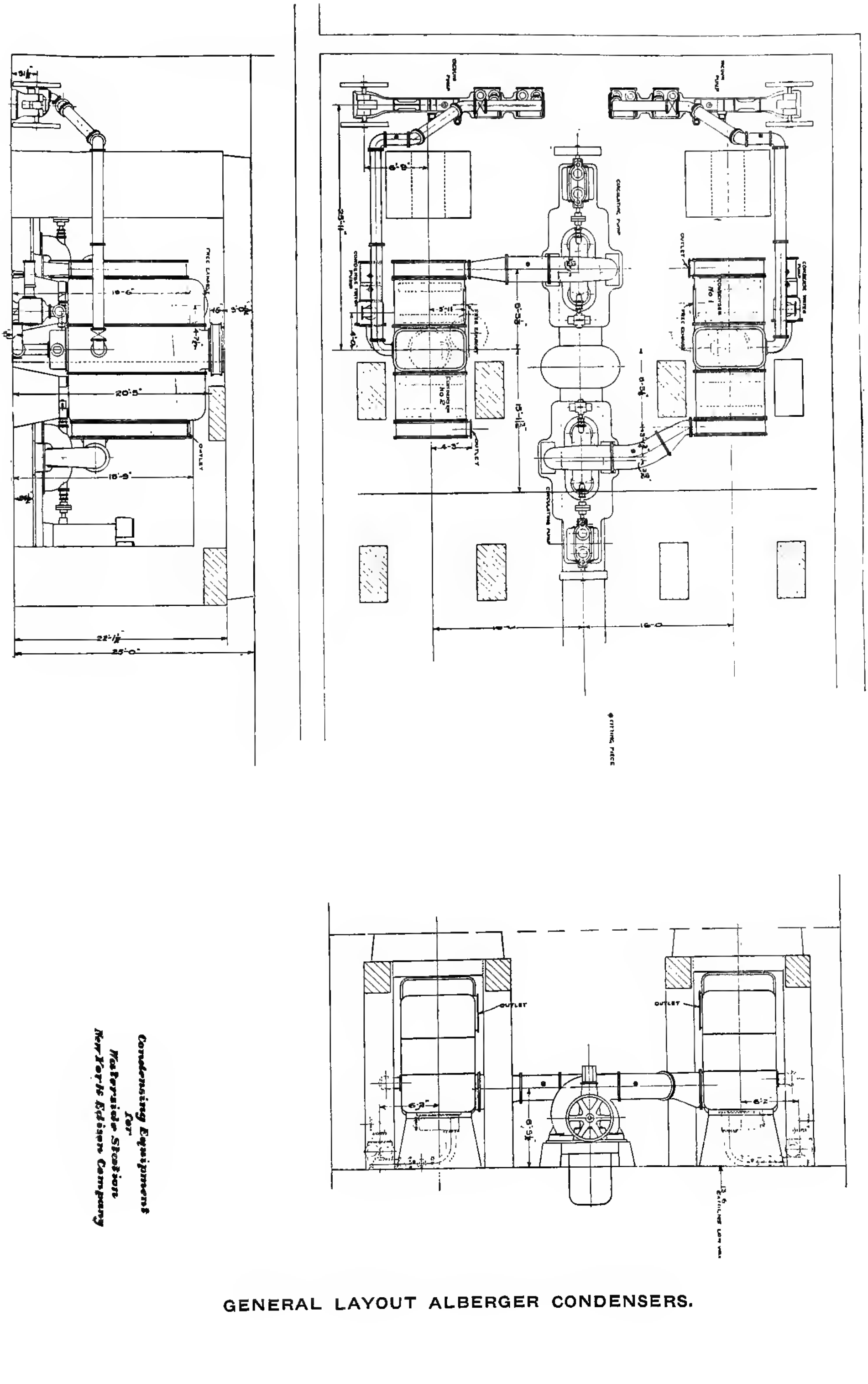
for the new Waterside Power Station

Being a part of the contract dated December 20, 1905, between the Alberger Condenser Company, Contractors, and The New York Edison Company.

CONDITIONS OF SERVICE AND GUARANTEE:

Each of the two condensing outfits hereinafter specified is to be run in connection with a steam turbine and is to be capable of condensing steam from same at the rate of 180,000 lbs. per hour and of maintaining a vacuum of 28 in. of mercury, referred to a 30 in. barometer, when supplied with condensing water at a temperature not exceeding 70 deg. Fahr. Furthermore, each of these outfits is to maintain a vacuum of 27½ in. of mercury, referred to a 30 in. barometer, when condensing steam at a rate not exceeding 220,000 lbs. per hour, temperature of circulating water not to exceed 70 deg. Fahr.

All piping, fittings and the turbines are to be tight and free from air leaks and the piping and fittings outside of those covered by these specifications is also to be tight and so designed as not to interfere with the successful operation of the apparatus covered by these specifications.



GENERAL LAYOUT ALBERGER CONDENSERS.

The above guarantees are to be obtained with the dry air pumps running at no greater speed than 100 r. p. m., circulating pumps 250 r. p. m., hot well pumps eighty double strokes per minute.

DELIVERIES:

The first condenser to be delivered, erected and in running order not later than May 20th, 1906.

The second condenser to be delivered, erected and in running order not later than June 20th, 1906.

APPARATUS AND MATERIAL COVERED BY THIS CONTRACT AND FOLLOWING SPECIFICATIONS.

Two (2) Standard Surface Condensers.
Two (2) Corliss Dry Vacuum Pumps.
Two (2) Centrifugal Circulating Pumps.
Two (2) Automatic Hot Wells and Hot Well Pumps.
Two (2) Expansion Joints.
Two (2) Sets of Piping.
Two (2) Sets of Gauges.

WORK TO BE DONE UNDER THIS CONTRACT:

The above apparatus and material to be delivered, erected and run under service conditions at the Waterside Station of the New York Edison Company, upon foundations with bolts provided by the Company.

The Company is to accord to the Contractor the use of such travelling cranes or other devices as may be available and without charge and is also to provide openings for the entrance of the apparatus and to remove as far as possible any existing obstacles to the proper and speedy erection of the apparatus, having due consideration for the work of other contractors.

DESIGN AND WORKMANSHIP:

The design as a whole and in detail and the workmanship to be to the approval of the Mechanical Engineer of the Company and his representatives.

DRAWINGS:

One copy each of the working drawings to be submitted to the Mechanical Engineer of the Company for approval before work is put in hand.

A book of drawings is also to be left with the Company for use of the Station Engineer and is to contain all working drawings.

CONDENSERS.

NUMBER:

There are to be two (2) surface condensers complete as per these specifications and in every necessary and usual detail.

SIZE:

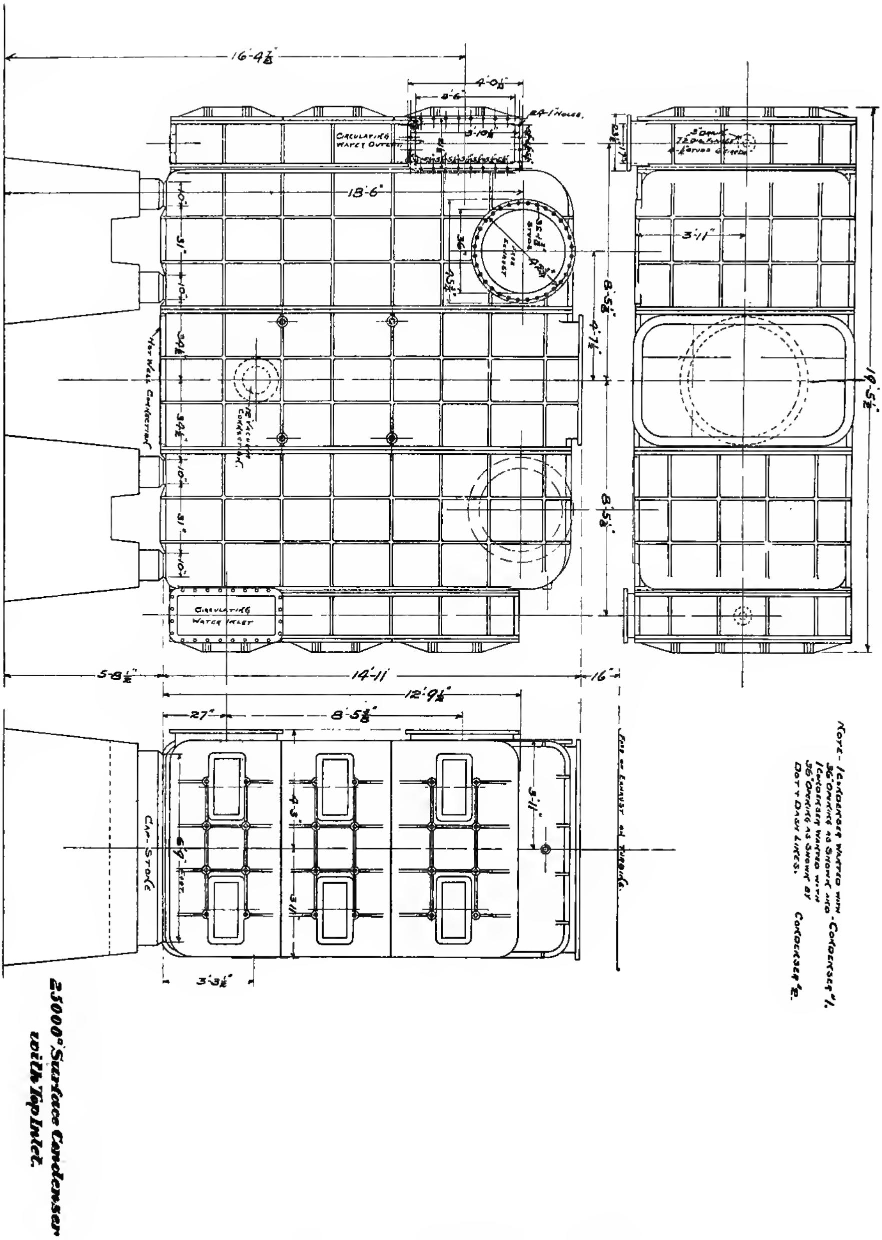
Each condenser is to contain 25,000 sq. ft. of surface measured on the outside of the tubes between the tube heads.

FORM:

These condensers are to be rectangular in form with the entrance for the exhaust steam on the top and with the entrance for the circulating water at the bottom and the exit of the latter at the top of the opposite end so as to give three passes of water through the condenser.

SHELL:

The shell is to be of close grained cast iron with properly placed openings for cleaning and inspection. The condensers are to have an ample steam space at the top and suitable means for proper distribution of the exhaust steam over the top of the tubes and throughout the tube space.



DETAIL OF SHELL, ALBERGER CONDENSER.

Heads to be of close grained cast iron bolted to shell and to have division plates so arranged as to pass the water three times through the length of the condenser. Doors on heads to be not less than one inch in thickness and well ribbed, to be provided also with at least two manhole doors and covers twelve inches by sixteen inches opposite each end of each pass. Studs for these covers to have case hardened nuts. A one-inch air vent will be provided at the top of each water head and also on the doors just below each division plate. A two-inch drain valve to be placed at bottom of each water head.

All joints in water ends to be of rubber. The flanges and faces are not to be porous. Each section of the shell must machine up in such a manner that while it allows a full thickness of flange yet the total length is such that the length of tube extending through the packing shall be as called for later.

If the tube sheets are held between the flanges of the shell and covers, the bolts for this purpose are all to be collar bolts or other suitable means so that condenser may be tested for leakage, and so that, while operating the same, we may take off the heads for removing the tubes without endangering the joint between tube sheet and shell.

The clearances between the sides of the shell and the sides of the outside vertical row of tubes is in no case to be greater than three-eighths of an inch.

Tube Heads:

The tube heads are to be of rolled brass not less than one inch thick carefully drilled to template and tapped to receive the threaded composition followers. The tube heads are to be so spaced that there will be in the first tube nest four steam channels through it of an aggregate area of thirty per cent of the area of the steam inlet nozzle on the condenser, and the second nest is to have three channels of an aggregate area of twenty per cent. of the steam inlet nozzle.

TUBES:

The tubes are to be of No. 18 B. W. G. of seamless drawn Muntz metal and are to be one inch outside diameter and between fifteen and sixteen feet long.

PACKINGS:

The tubes are to be secured in the tube heads by means of Argand wick packing held in position by followers or glands of composition. These glands are to be so constructed as to prevent the tube from crawling out of the packing.

The tubes are to be of such a length that with at least one-fourth of an inch of solid packing and the glands screwed in at least one-half of an inch at both ends of the tubes, that when the tube is driven tight against the shoulder of the ferrule at one end it will project at least five-sixteenths of an inch beyond the one-fourth of an inch of packing at the other end. The ferrules to be of such a length that with the above conditions there is at least one-quarter of an inch of total play between the ends of the tubes and the shoulders on the ferrule.

The ferrule holes are to be clean tapped to the bottom of the packing space.

CHANNELS:

See Shells.

SUPPORTING PLATES:

Each condenser is to have two supporting plates extending from the bottom to the top of the shell and supporting in two places all of the tubes of the condensers. These supporting plates to be of cast iron approximately one inch in thickness carefully drilled to template to receive the tubes, and all burrs cleaned off. An additional supporting plate will be provided under the steam inlet to take in six vertical rows of tubes the whole width of the condenser.

Openings:

There is to be one opening on the top of the condenser rectangular in form equal to the area of the exhaust opening of a 7,500 K. W. steam turbine. There is to be a non-condensing exhaust opening forty-two inches in diameter, or equivalent area located on the side of the steam space for free exhaust to the atmosphere. There is to be a condensed water opening on the bottom of the condenser through which the water of condensation is to pass to the condensed water pump. There is to be an air opening on the side of the condenser at the top of the lower pass which is to allow the air to pass to the dry vacuum pump. There is to be a circulating water inlet at the bottom of one channel and an outlet at the top of the opposite channel. There will also be an opening about half way up the condenser which will be connected to the suction of the hot well pump for removing the vapor therefrom. Other smaller openings to consist of drains, air vents, etc.

Material and Workmanship:

The material and workmanship of these condensers to be first class, of a kind suitable for the purpose, and to approval of the Company. All bolts and nuts exposed to circulating water to be of bronze.

Principle of Operation:

The separation of the water of condensation and the air remaining after condensation is to take place within the condenser in such a manner that the condensed water is withdrawn from the bottom of the condenser while the air passes upward around the cool tubes containing the incoming cold circulating water as it flows to the opening which connects to the dry vacuum pump. This separation, diversion and cooling of the air is accomplished by means of a division plate in a manner covered by letters patent. All of the functions of an outside air cooler and hot well are thus accomplished without extraneous attachments.

DRY VACUUM PUMPS

DESCRIPTION:

There are to be two (2) dry vacuum pumps. These dry vacuum pumps are to be of the horizontal pattern having steam and vacuum cylinders mounted upon one common cast bedplate which is to also carry the crank end, the steam cylinder being placed between the vacuum cylinders and the crank end. The steam and vacuum cylinders in addition to being mounted upon the bedplates are to be connected rigidly by horizontal tie rods.

SIZE:

Each dry vacuum pump is to have one 10" x 24" steam cylinder and two 24" x 24" vacuum cylinders working in multiple.

SPEED:

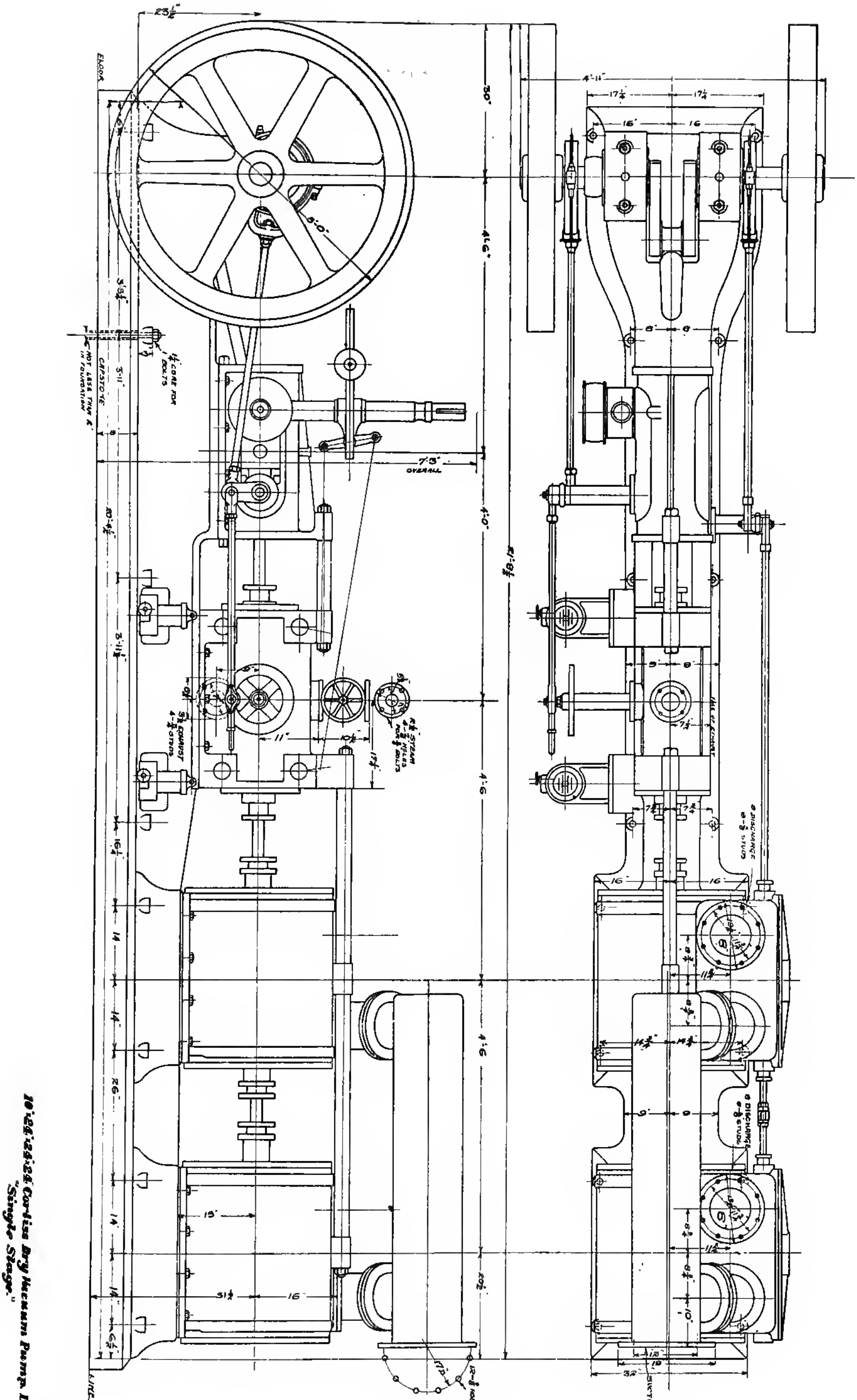
The normal speed of these vacuum pumps to be 100 rev. per minute but they are to be capable of operating at a lower rate of speed according to the requirements of the service. Steam pressure for most economical operation 175 pounds.

STEAM CYLINDERS:

Steam cylinders to be of close grained iron of ample thickness for reboring. To be provided with indicator openings.

STEAM PISTONS:

The steam pistons are to be made with spider and adjustable bull rings, fitted with a single self-adjusting packing ring; this ring where split to be covered with a brass keeper making a steam tight and self-adjusting joint. The ring is to be held to the bore of the cylinder by light corrugated springs.



GENERAL DRAWING ALBERGER DRY VACUUM PUMP.

STEAM & EXHAUST VALVES:

The steam and exhaust valves are to be of the Corliss type, cylindrical in form and operated by a standard releasing gear swinging on a common centre with the valve stems, and permitting of high speed in case of emergency without undue noise or jar.

The releasing catches are to be provided with hardened steel hook plates made removable and are to have eight wearing edges. The valve connections are to permit of the closest adjustment while the vacuum pumps are running, thus facilitating the setting of the valves with the indicator.

VALVE STEMS:

The valve stems to be made of solid phosphor bronze or steel at the option of the Company. The tee heads are to be detachable from the valve.

VALVE BONNETS:

The valve bonnets are to be of the cone style and highly polished.

WRIST MOTION VALVE GEAR:

The wrist motion valve gear is to be designed to give the quickest possible action to the valves. The steam and exhaust valve bearings are to be large and the valves are to seat by gravity thus taking up their own wear without the use of springs.

DASH POTS:

The dash pots are to be of the vacuum type with air cushioning regulator; the vacuum plunger is to be arranged with self-adjusting packing so that a high uniform vacuum may be obtained, giving the quickest possible action in closing the valves

REGULATING GOVERNORS:

The regulating governors are to have levers with sliding weight adjustments and automatic speed stop motion, which are to operate in case of breakage of governor belt so as to stop the vacuum pump. Any variation of speed necessary is to be accomplished by an adjustment of the governor while running, the function of the governor being to maintain a constant speed under all variations of load, due to fluctuation of vacuum and steam pressure.

VACUUM CYLINDERS:

The vacuum cylinders are to be of fine close grained cast iron of ample thickness for reboring. One side of each cylinder is to be provided with a valve chest in which are to be placed the positively actuated air inlet valve and automatic outlet valves. Cylinders to be provided with indicator openings.

WATER JACKETS:

The vacuum cylinders and also the front and back cylinder heads are to be water jacketed for the circulation of cooling water.

AIR VALVES:

The outlet air valves to be of special composition and automatic in their action, these valves are to be guided by tubular stems sliding in a tubular guide and held to their seats by light composition springs. The inlet valves are to be of the slide valve type operated by means of an eccentric and suitable valve rod connections from the main crank shafts. These positive inlet valves to be provided with a flash port which is to connect the two ends of the air cylinder when the air piston is at the extreme end of the stroke and is in this manner to allow the air atmospheric pressure in the clearance space to expand back into the opposite end of the cylinder at the end of the stroke, reducing the pressure in the clearance space to practically that of the vacuum being carried and thus eliminating the prejudicial

effect of the clearance. Particular care to be had that the valve faces and seats of the slide valves are free from patches and any imperfections, and that they are scraped to a true flat surface all over.

Piston Rods:

The air and steam piston rods are to be of steel of ample size and securely fastened to the pistons with nuts and lock nuts.

Fly Wheels:

There are to be for each machine two fly wheels approximately four feet in diameter of ample weight and with faces turned true.

Crank Shafts:

The crank shafts are to be of the best hammered iron each made in one piece and having diameter and bearings of ample proportion for the work to be performed.

Main Frames:

The main frames are to be of the box bedplate type and to extend under the entire length of each pump supporting the vacuum cylinders, steam cylinder, guide and crank shaft. They are to be extremely rigid so that the machine will maintain its alignment during shipment and when placed upon the foundations.

Crossheads:

The crossheads are to be of the solid box form with forged steel crosshead pin and crosshead shoes are to have circular bearings on wearing surfaces lined with genuine babbitt metal; the shoes are to be adjustable vertically by parallel wedges. The crosshead pin and shoes are to be capable of ready removal by taking crosshead off from the piston rod.

Connecting Rods:

The connecting rods are to be of the best forged iron with babbitted bronze boxes and to have wedge and screw to adjust for wear.

Pillow Blocks:

The pillow blocks are to be extra heavy, cast on main bed-plate and provided with boxes made in four parts; these boxes to be arranged to be taken out without removing the shaft, and are to be adjustable for wear by means of large screws. There is to be provided a large reservoir on top with special sight feed valves arranged so that no sediment can flow into the journal; these boxes are to be lined with genuine babbitt metal.

Lagging:

The steam cylinders are to be covered with best non-conducting material and encased with No. 14 B. W. G. sheet steel lagging.

Wrenches and Oil Cups:

There will be provided suitable wrenches for the removal of all nuts, Richardson pump for steam and vacuum cylinders and necessary oil cups for bearings are to be furnished. The lubrication of the air cylinders is to be a matter of careful design. Lubrication of steam cylinders to be supplied through Richardson pumps.

Foundation Plans:

Complete foundation plans showing the position of the foundation bolts and size and location of steam and air openings are to be furnished.

Workmanship and Material:

All workmanship, material and finish to be first-class and in keeping with the best engine practice. The vacuum in the air cylinders is to come within one pound of absolute when the inlet nozzle is blanked off.

CIRCULATING PUMPS

Description:

There are to be two (2) centrifugal circulating pumps.

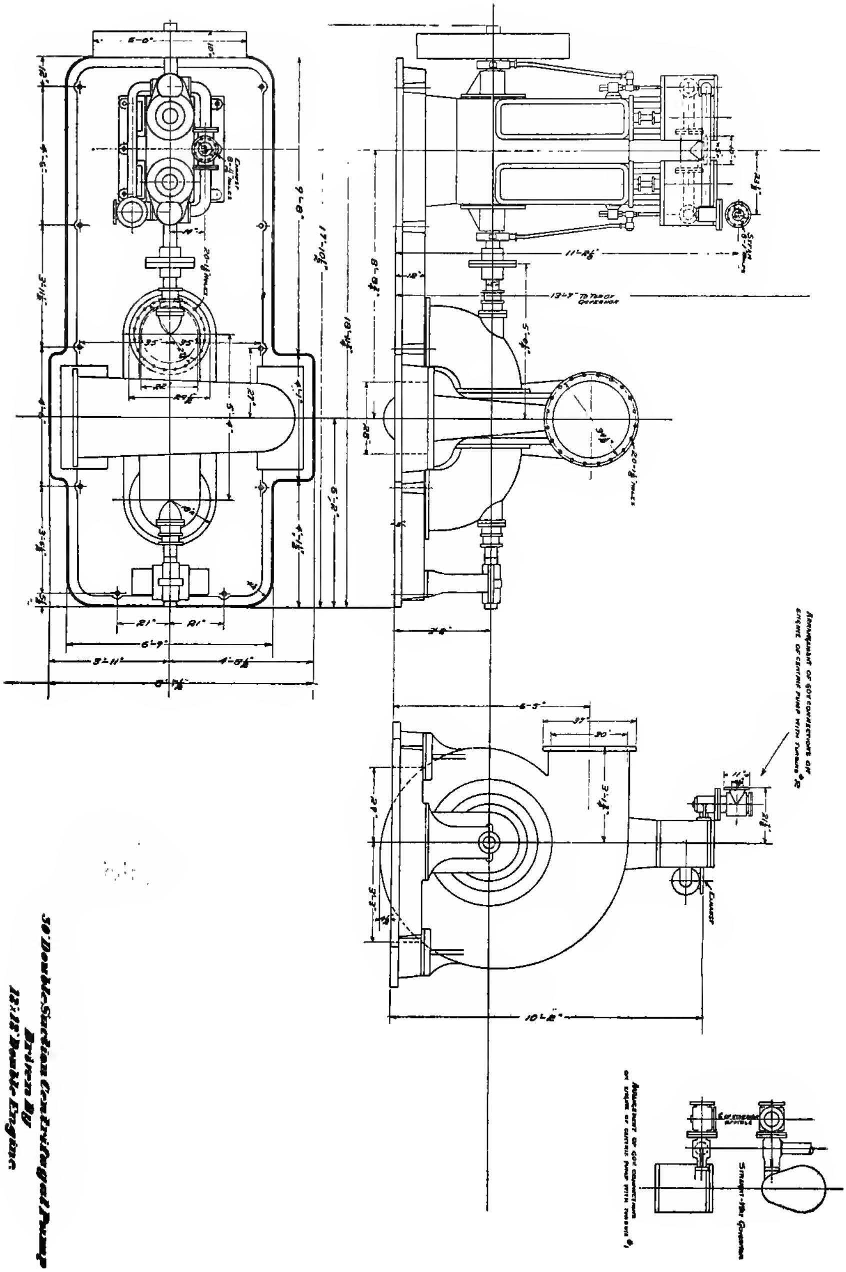
These circulating pumps are each to consist of a centrifugal pump mounted on the same bedplate and directly connected to a pair of vertical steam engines. The centrifugal pumps are to be of the double suction balanced type and the engines are to have piston steam valve and are to be controlled by a throttling governor. The cranks are to be set at ninety deg. so that the engines will start up at any point of the revolution.

Size:

Each centrifugal pump is to have two twenty-two inch suction openings and one thirty inch discharge opening. The pair of engines is to have two twelve by twelve inch cylinders or larger if necessary to obtain the required power to handle the necessary amount of water with cut off not to exceed fifty per cent of stroke. Cylinders to be mounted upon the same crank shaft.

Speed:

The normal speed of these circulating pumps to be two hundred and fifty rev. per minute but they are to be capable of change of speed while running by an adjustment of the governor. The steam pressure for most economical operation is 175 lbs.



GENERAL DRAWING ALBERGER CIRCULATING PUMP AND ENGINE.

CENTRIFUGAL PUMPS:

The centrifugal pumps are to be of the improved double suction type so arranged that the water enters the pump from both sides at and directly opposite the centre of the revolving impeller forming a balanced suction and dispensing entirely with end thrust of shaft. The shell of each pump to be a true volute cast separately from the two side plates which are bolted thereto. This shell to be of cast iron of ample thickness and to be bored and faced where the two side plates are secured. Upon the highest part of this pump shell, there is to be provided an opening for priming connections and a suitable opening is also to be arranged at the bottom of the pump for the purpose of draining the pump casing.

SIDE PLATES:

The removal side plates are to be provided upon each side of the pump and the interior surfaces are to be machine finished. These side plates are to be slightly larger in diameter than the impeller so that the latter with its shaft may be removed.

IMPELLERS:

The impellers are to be of the enclosed type. The form of the blades of the impellers is to be such as will result in the highest efficiency under the conditions of service. The impellers are to be keyed firmly upon the shafts and balanced for quietness at the speed of running.

SHAFTS:

The shafts are to be of best quality mild steel covered with composition where they are in contact with the circulating water and where they pass through the stuffing boxes.

STUFFING BOXES:

The stuffing boxes upon each side of the pumps are to be made in two parts so that they can be easily removed from the shaft without disturbing any parts of the pumps.

WATER PACKING:

The stuffing boxes are to be provided with lantern glands taking water from the discharge pipe so as to prevent leakage of air around the shaft.

SUCTION ELBOWS:

The suction elbows are to be of cast iron and of a shape to give an easy entrance of the water to the pump casing consistent with compactness of the machine. On the highest point of the suction, a bossed opening for 2½″ pipe is to be left for attaching an air syphon.

SHAFT COUPLINGS:

Forged shaft couplings are to be provided to connect the pump shaft with the engine shaft.

STEAM CYLINDERS:

These steam cylinders of the engine are to be of close grained cast iron of ample thickness for reboring and are to be lagged with 85 per cent. magnesia and No. 14 sheet steel secured with steel bands or cast iron stoves.

FRAMES:

The frames of the engines to be enclosed so that all of the moving parts may run in oil. Each frame is to be provided with a door on the side to give free access to the interior. The crank casing is to have a top plate fitted with stuffing boxes where piston rods go through. The cylinders are to be separated from the frames by a distance piece giving ample space to work on cylinder stuffing boxes.

PISTON VALVES:

The steam inlet and outlet valves to be of the plug-piston type with grooves instead of rings and are to be provided with removable liners and bridged ports.

Crank Shafts:

The crank shafts to be of forged steel made in one piece and are to be balanced with counter weights.

Connecting Rods:

The connecting rods to be of forged steel and of the marine forked type. The boxes for the crank pin and crosshead pin to be of bronze, lined with best babbitt.

Governor:

The governor to be of the centrifugal throttling type with safety attachment to prevent running away in case of breaking of the governor belt, also to be fitted with attachment to permit of change of speed while running.

Bedplates:

Each of these circulating units is to have a substantial cast iron bedplate which is to support the pair of engines and centrifugal pump. This bedplate is to be provided with a lip around the outer edge to collect oil and other leakage. Suitable opening is to be provided to drain off the liquid collected.

Bearings:

Bearings of the centrifugal pump to be babbitted and independent of shell.

Material and Workmanship:

All forgings are to be of the best open hearth steel and all castings are to be free from blow holes or flaws. The cast iron in the steam cylinders is to be close grained, hard and uniform in character. All parts requiring babbitt lining are to be fitted with genuine babbitt. The engine is to be arranged with all necessary connections for drips and to be provided with openings for indicators. All nuts subject to use to be case hardened. The material and workmanship to be first class and of a kind suitable for the purpose. The cylinders are to be carefuly cleaned of

any core, sand, chips, filings, etc. just before erection, and if required by the Mechanical Engineer of the Company cylinders are to be pickled when they come from foundry. Centrifugal pump shell to be subjected to a water pressure of 30 pounds.

All pins and bearings throughout to be adjustable. Cylinder lubrication to be supplied through a Richardson sight feed pump and all other lubrication arrangements to be specially complete and subject to approval.

HOT WELLS AND HOT WELL PUMPS

NUMBER:

There are to be two (2) automatic hot wells and hot well pumps of the duplex direct acting type.

CAPACITY:

Each hot well pump is to be 8 x 10 x 12 or equivalent and capable of removing 250,000 lbs. of steam per hour and of delivering same against atmospheric pressure at a height not more than 25 ft. above the pump. The piping between the pump and this receptacle to be of ample size.

AUTOMATIC HOT WELL:

The hot well is to consist of a closed cast iron chamber suitably attached to the bottom of the surface condenser so that the water of condensation will freely flow into the former. This hot well will contain an open float which will be filled with water and it shall be counter-balanced by means of a spiral composition spring. The motion of the float is to be transmitted by means of a stem through a stuffing box. A crank on the outer end of the stem is to operate the valve of a balanced steam valve on the supply pipe to the hot well pump.

Specifications of Piping.

There are to be two (2) sets of piping for each condenser with its circulating, vacuum and hot well pump. This piping is to consist of discharge pipe from circulating pump to condenser.

Air pipe from condenser to dry vacuum pump.

Water pipe from condenser to hot well and hot well pump, and also equalizing or vapor pipe to condenser side. All piping is to be subject to approval of the Company and according to their plans.

Specifications of Gauges.

There are to be two (2) sets of gauges, one for each condenser.

One vacuum gauge for suction of circulating pump.

One discharge gauge for discharge of circulating pump.

One absolute vacuum gauge for condenser.

Two thermometers and two wells, Hohmann & Maurer.

The three gauges are to be mounted on a neat cast iron gauge board and placed in an approved position.

Specification of Expansion Joint.

There are to be two (2) expansion joints, one for each condenser. These joints to consist of two iron flanges with connecting piece of copper arranged to take up any slight movement between the piping and the condenser shell or between the turbine and condenser shell if the condenser is placed close to the turbine opening. All nuts, bolts and gaskets are to be included.

Hot Well Pump:

The hot well pump will be connected to the hot well by means of a short suction pipe and through this pipe will receive the water of condensation which is to discharge to the elevated receptacles. The speed of this pump is to be controlled by the

above mentioned balanced valve to remove the water from the hot well at the same rate as it is formed in the condenser. The speed of this pump in regular operation not to exceed 70 ft. per minute piston travel. The cylinder linings and piston rods of this pump to be of composition and the suction valves to be of light sheet metal and discharge valves of rubber.

Lubricator:

This pump to be fitted with a one quart Detroit sight feed lubricator.

Material and Workmanship:

The material and workmanship of these hot wells and pumps to be first-class and of a kind suitable for the purpose. The valve motion of this pump to be of forged steel and all valve seats are to be screwed or otherwise securely fastened to their valve decks.

Superheated Steam:

As 100° superheated steam will be used on this apparatus, particular care will be used in the lubrication of all valves.

Wrenches:

A complete outfit of wrenches and special tools will be furnished for each of these installations.

Stair Railings:

All stairs, ladders and railings to be according to the standard design of the Company.

SPECIFICATIONS

Accompanied by Drawings for

Two Surface Condensing Equipments

for the new Waterside Power Station

Being a part of the contract dated March 2, 1906, between Henry R. Worthington, Incorporated, Contractors, and The New York Edison Company.

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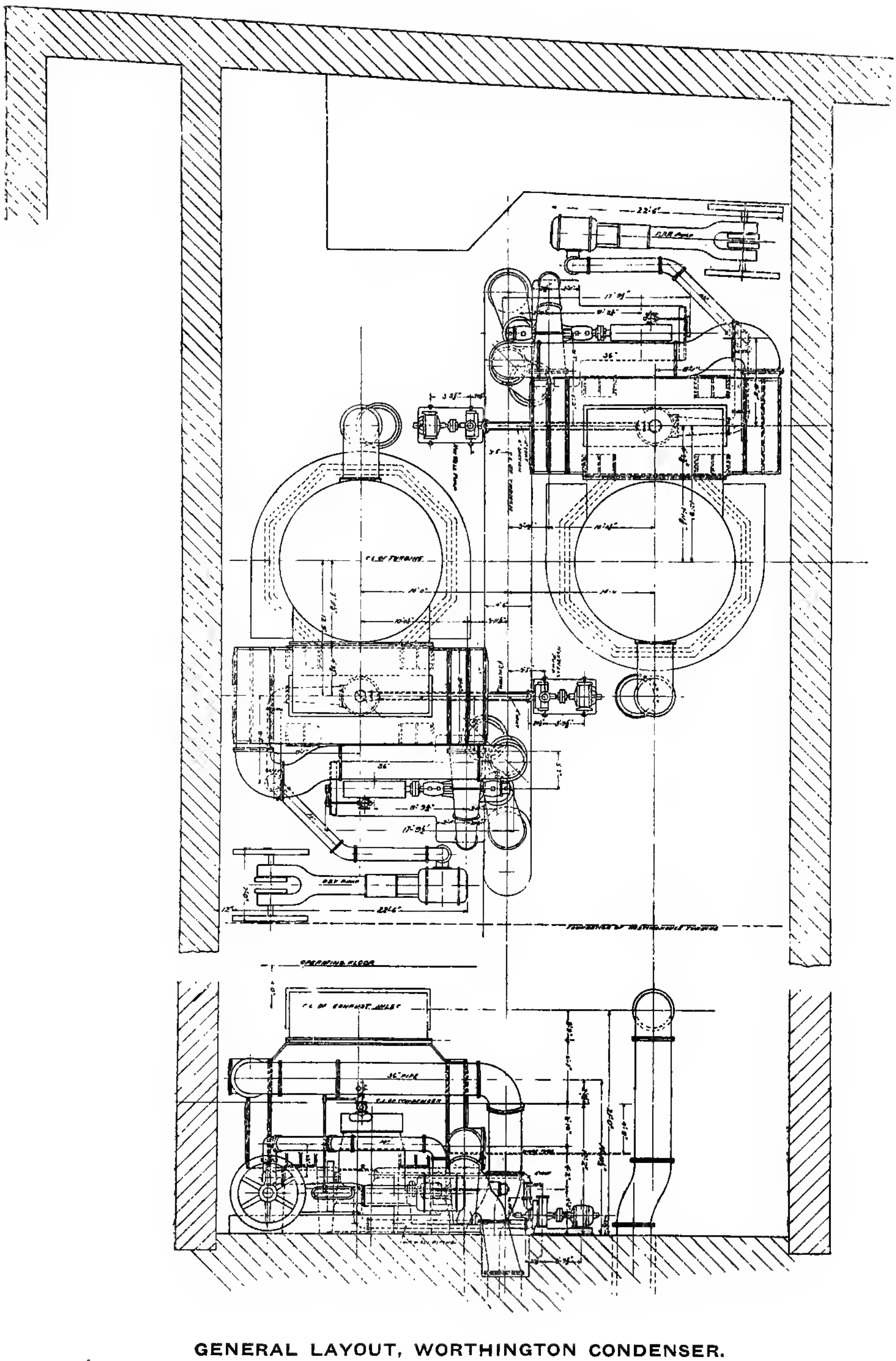
1. Description—Of one equipment:

Condenser:

The condenser is to have 25,000 square feet of cooling surface, with ample steam space at the top to insure uniform distribution of the exhaust steam throughout the tube space; it is to be capable of condensing continuously 180,000 pounds of steam per hour and of forming and maintaining uninterruptedly, while so doing, a vacuum of 28 inches; or when condensing continuously 220,000 pounds of steam per hour, of forming and maintaining uninterruptedly a vacuum of 27½ inches; both of these absolute pressures being referred to a requisite supply, per unit of time, of circulating water at a temperature of 70 degrees Fahrenheit, a barometric reading of 30 inches and a proper as-



GENERAL LAYOUT, WORTHINGTON CONDENSER.

sembling of all parts associated with the forming and maintaining in the condenser of the desired absolute pressure.

The body of the condenser is to be rectangular in form, of proper design and thickness and provided with a Worthington inner cooler. As it is not to rest on the air pump, it is to be provided with suitable supporting saddles or feet so arranged as to permit of its resting upon such proper piers, columns, beams or other supports as will be installed for that purpose by this Company.

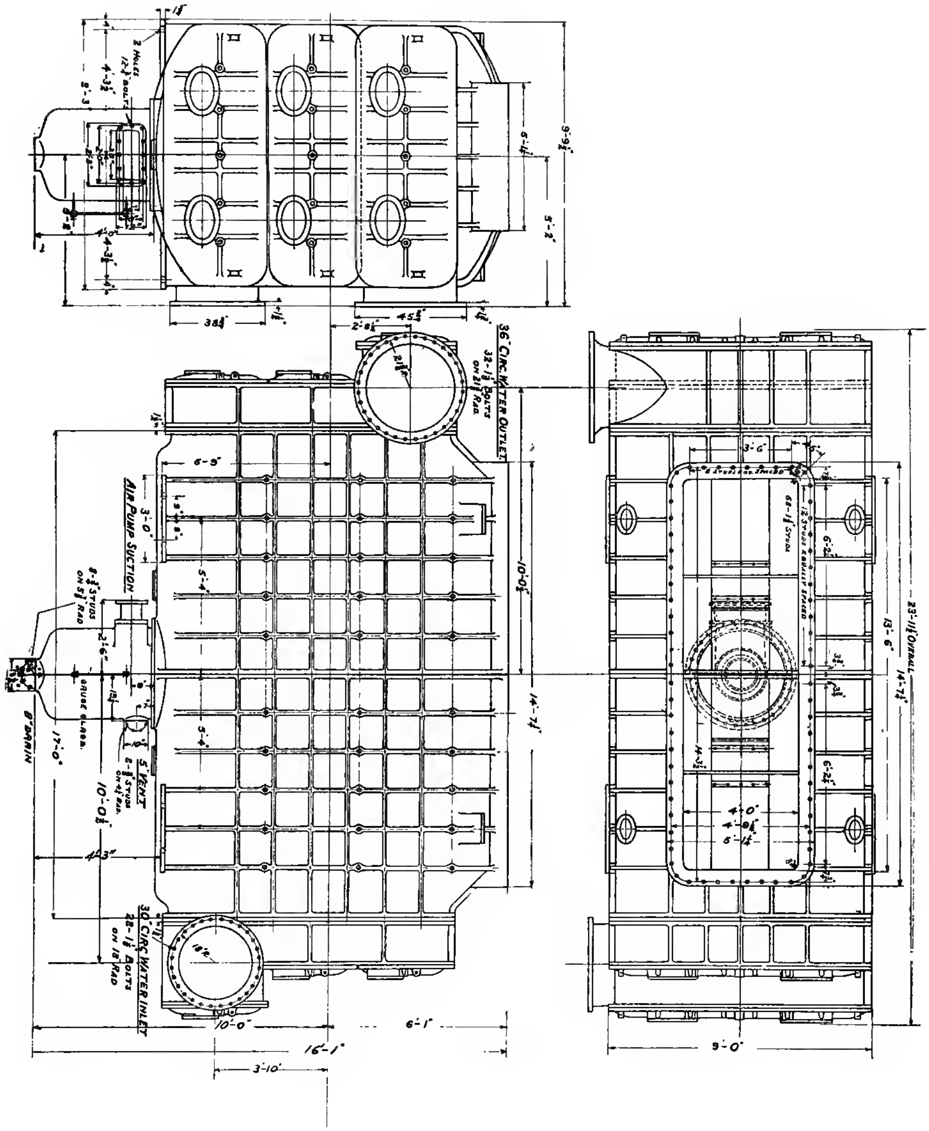
The hot well is to consist of a suitable receptacle, or reservoir, which is to be provided at the bottom of the condenser body and to which the suction of the hot well pump is to be connected.

A suitable baffle plate is to be provided and so arranged as to efficiently distribute the exhaust steam throughout the space provided therefor and to relieve the tubes of its impact.

A suitable supporting plate for the reception and support of the condenser tubes is to be provided and located and properly fastened mid-way of their lengths and, in adition, arranged so as to assist in the distribution of the exhaust steam.

Each tube is to consist of one uninterrupted, straight length of such material as is later herein specified and without upsets or flanges; and, during the operation of the condenser, all of the outer surface of each tube is to be in effective contact with the steam to be condensed.

A suitable stuffing box, having an internal screw thread, is to be provided in each tube head for each end of each tube, and through which boxes the tube is to pass, with sufficient projection thereinto to permit of properly packing it. Each stuffing box is to be provided with a ferrule having an external screw thread and an inner, circumferential projection or lip; the object of this lip being to secure the tube in position by limiting its "creeping", though, at the same time, allowing freedom for expansion and contraction. This ferrule is to act as a gland for the stuffing box—being screwed into the latter through the medium of a special tool applied to a transverse slot in one end of the ferrule—rendering at the same time a readily possible and



DETAIL OF SHELL, WORTHINGTON CONDENSER.

practicable provision for removing the tubes or repacking the stuffing box.

Circulating Pump:

The circulating pump is to be of the Worthington, horizontal shaft, volute type having a single, side suction and enclosed impellers. It is to be capable of delivering to the condenser 27,000 gallons of circulating water per minute against a total head of 20 feet when operated at a speed not to exceed 250 R. P. M.

The suction opening and the discharge opening are each to have a minimum diameter of 30 inches.

The main casing is to be volute in form and of proper thickness to withstand all stresses incident to normal service. The side plates are to consist of removable covers making a male and female fit with the casing and fastened thereto by means of suitable bolts. The general design is to be such as will permit of the removal of the internal parts without entirely dismantling the pump.

The impellers are to be of the enclosed type, cast in one piece and having a single, side suction; and with a balancing chamber—thus reducing the end thrust to a minimum. The impeller casting when mounted, with all moving parts, on the shaft is to be in perfect rotative balance.

The shaft is to operate in outboard bearings to be carried on brackets extended from the main casing. The shaft is to have the necessary and proper stuffing boxes, the latter, where required, to be provided with water seals consisting of lantern glands in the boxes, and connected by means of suitable piping with the water under pressure on the discharge side of the pump. This method of sealing is to effectually prevent suction air leaks, an essential to the successful operation of the pump. The shaft is to be provided with a shoulder against which the impeller casting will be held by means of a nut on the suction side.

The circulating pump is to be operated by a direct-connected

steam-driven Morris engine. This engine is to be of the vertical, two-cylinder, simple, non-condensing, high-speed, crank-case type. It is to be of 240 B. H. P. capacity, and when run at its normal speed of 250 R. P. M., with a pressure, per square inch, above the atmosphere, at the throttle, of 175 pounds of steam with 100 degrees of superheat, the circulating pump, to which it is to be connected, shall deliver to the condenser the hereinbefore specified quantity of circulating water under the conditions there stated.

The cylinders are each to be of a diameter of 12 inches and a stroke of 12 inches.

The valves are to be of the piston type.

The steam inlet and the exhaust outlet are to be 5 inches and 6 inches in diameter respectively.

The frame of this engine is to be of the type fully enclosing a certain portion of the reciprocating and other moving parts—commonly known as "crank-case"—and providing thereby, for such parts, one of the means for a system of "splash" lubrication.

In the front of the crank-case portion of the frame two openings and in the back one opening, all of rectangular form, are to be left for easy access to the interior thereof. Those openings are to be closed by hinged doors with gaskets to form oil-tight joints and secured by the requisite number of cap screws.

The upper end of this enclosing portion of the frame is to be formed by a horizontal head or partition, which shall separate the cylinders from the crank-case proper by a distance sufficient to allow easy access to the main stuffing boxes and to the auxiliary stuffing boxes or water glands which are to be provided in this horizontal head or partition. Proper openings are to be left into this separating space for the before mentioned access to the stuffing boxes; and which openings are to be closed, dust-tight, by removable cast iron doors fastened by the proper number of cap screws.

The crank shaft is to be a one-piece forging, fitted with a fly wheel of suitable proportions and proper flange coupling.

The cranks are to be counterbalanced.

A suitable bed-plate to receive and have properly secured thereto, the circulating pump and its engine is to be furnished by the Contractor.

Turbine Hot Well Pump:

Each hot well-pump is to be of the horizontal shaft—two stage—turbine type, having a single, side suction and enclosed impellers. Each pump is to be capable of delivering, against a total discharge head of 25 feet, 500 gallons of condensed steam per minute from the hot well at the bottom of the herein specified surface condenser with which it is to be connected, and in which there is being maintained, at the time, an absolute pressure corresponding to the reading on a mercury column of 28 inches or more, coincident with a barometric reading of 30 inches.

The suction opening and the discharge opening are to have minimum diameters of 6 inches and 5 inches respectively.

The suction connection is to be of special design and provided with a vapor pipe inlet to the condenser shell.

The main casing is to be annular in form, of sufficient thickness and provided with suitable feet.

The suction head is to be of such design as to permit of the removal of all internal parts without entirely dismantling the pump.

There are to be provided all necessary openings, such as suction, discharge, drain, vent, etc.

The impellers are to be of the enclosed type, cast in one piece and having a single, side suction, and with a balancing chamber—thus reducing the end thrust to a minimum.

The discharge from each impeller is to be conducted through a set of stationary guide or diffusion vanes so designed as to transform velocity into pressure with the least possible loss of efficiency.

These vanes are to be easily removable, should such removal be necessary or desired.

The shaft is to operate in outboard bearings, to be carried on brackets extended from the main casing. The shaft is to have the necessary and proper stuffing boxes, the latter where required,

to be provided with water seals consisting of lantern glands in the boxes, and connected by means of suitable piping with the water under pressure on the discharge side of the pump. This method of sealing is to effectually prevent suction air leaks, an essential to the successful operation of the pump on high vacuums. The shaft is to be provided with a shoulder against which the impeller casting will be held by means of a nut on the suction side.

The hot well pump is to be operated by an electrically-driven motor which the Contractor is to furnish. The motor is to be wound for a direct current of 220 volts, and it is to be of 20 h. p.

Dry Vacuum Pump:

The dry vacuum pump is to be steam-driven and of the Laidlaw-Dunn-Gordon-single-horizontal-tandem-rotative type.

The steam cylinder is to be of a diameter of 13 inches; the air cylinder is to be of a diameter of 32 inches; both cylinders are to be of a stroke of 24 inches.

The valves for the steam end are to be of the Corliss type; those for the air end are to be of the Cincinnati type.

The steam inlet and the exhaust outlet are to be 3 inches and 4 inches in diameter respectively.

The air cylinder is to have a water jacket which shall completely surround it; the coring to be so arranged as to ensure the most thorough and effective circulation of the cooling water. The construction of the heads and of the connecting housings is to be such that all of the air joints may be broken and renewed without disturbance of the other parts.

The air suction valves are to be enclosed and suction ports are to be provided, thus ensuring quiet action and permitting the air to be drawn from the coolest source conveniently available.

All clearances are to be of the minimum volume—the head and the piston being faced to ensure this.

The air cylinder is to be provided with an improved positive motion gear.

The frame of this air pump is to be of the forked type, with

one main bearing, of the quarter-box design, located on each side of the crank.

The crank shaft is to be of forged steel and have two properly proportioned fly wheels.

CONNECTIONS AND EXPANSION JOINT:

An exhaust connection from the exhaust nozzle of the turbine to the exhaust nozzle provided therefor on the condenser is to be furnished by the Contractor. It is to be of proper size and form to suit the requirements of the installation.

All the necessary air and water connections, of sizes and forms to comply with the local necessities, are to be included in the herein specified condensing equipment.

2. MATERIAL:

CONDENSERS:

The shells and the heads, and the bonnets and the cover heads are to be of cast iron.

The tube heads are to be of brass.

The tubes are to be of Admiralty mixture.

The ferrules (glands) for the tube head stuffing boxes are to be of brass.

The packing is to consist of fibre and corset lacing, as adopted by the Bureau of Steam Engineering of the United States Navy, or Allen's patent packing.

All interior bolting which is to be in contact with the circulating water is to be of composition.

HOT WELL PUMPS:

The main casings, impellers and diffusion vanes are to be made of a strong, close-grained cast iron.

The shafts are to be of machine steel.

Circulating Pumps:

The main casings, side plates and impellers are to be made of a strong, close-grained cast iron.

The shafts are to be of forged steel.

Engine for Circulating Pumps and Dry Vacuum Pumps:

All cylinders are to be of a selected, close-grained cast iron, as hard as can be machined.

The frames and bed plates and fly wheels are to be of a good, close-grained gray cast iron.

The cross-heads are to be of cast steel and are to be babbitt faced.

The connecting rods and crank shafts are to be of forged steel.

3. Finish:

All cylinders are to be bored true and smooth and to be sufficiently thick to allow re-boring twice. They are to be tapped for connections for indicators, drains, etc. and those of the circulating pump engines are to be lagged with 85% carbonate of magnesia which is to be covered with Russia iron held by steel bands. The steam cylinders of the dry vacuum pumps are to be lagged with 85% carbonate of magnesia which is to be covered with planished iron held by polished angle iron corners in the usual manner.

All pistons are to have self-adjusting rings.

All piston rods are to have approved packing.

All pump shafts and crank shafts are to be accurately machined and polished; the pump shaft to be close fits in their hubs.

All usual and necessary parts are to be properly finished.

The out-board bearings are to be babbitted and ring-oiled.

The fly wheels are to be keyed to the shafts and have rims of square cross-section, turned true and faced on their sides.

There shall be provided all usual and necessary means for adjustment for wear.

All joints of the crank-cases shall be oil-tight.

The tube heads and the supporting plates of the condensers are to be properly drilled for the reception of the tubes; those in the tube heads to be, in addition, tapped to receive the glands of the stuffing boxes.

The impellers of the hot well pumps and of the circulating pump are to be machined and polished.

All cored water passages of the hot well pump and of circulating pump are to be clipped and filed smooth.

The diffusion vanes of the hot well pump are to be ground and polished.

All nuts subject to frequent removal are to be case hardened.

Openings ample in number and in size are to be left in the condenser shells and in the pumps casing for interior access or other purpose, and provided with suitable covers or plates.

The casing of each circulating pump is to be provided with a boss, drilled, tapped and plugged for the later attachment of an air ejector for the purpose of priming the pump.

All flanges shall be properly faced and drilled.

All the usual and necessary fixtures throughout shall be furnished by the Contractor, including Richardson sight-feed lubricators, grease and oil cups, cylinder relief valves, cylinder drain cocks or valves, the vacuum and pressure gauges and the thermometers and their wells as hereinbefore specified and complete sets of drop forged wrenches.

All material and workmanship are to be satisfactory to the Engineer.

4. TEST:

The condenser tubes are to be subjected to an internal, cold, hydrostatic pressure test of 500 or more pounds per square inch.

Acceptance tests of the condensing units shall be made prior to the final payment therefor; these tests to be conducted by representatives of the Company and of the Contractor on such lines as shall be later determined.

5. Erection:

The Contractor is to do all the erecting of the equipments herein specified to be furnished by him; leaving all joints absolutely tight against leakage and all complete and ready for service.

The Company will supply and erect the necessary foundations, supports and anchor bolts; leaving the same ready for reception of the herein specified equipments. It will also supply the suction connections from the circulating water wells to the nozzles of the circulating pumps and the discharge connections from the discharge nozzles of the condensers to the discharge wells; and all steam, exhaust and drip piping for the engines of the circulating and dry vacuum pumps.

A travelling crane, with a capacity of fifty tons, will be in service in the station and may be used by the Contractor for erecting the herein specified equipment.

6. Guarantee:

The Contractor guarantees that the equipments herein specified to be installed by him will be efficient and satisfactory appliances for their intended purpose under the conditions stated; and he further guarantees all material and workmanship entering into their installation for the term of one year; and without that time will replace, without charge therefor, any imperfect part.

Painting:

The exteriors of the condenser bodies and of the casings of the pumps are to receive each a coat of filler and a finishing coat of paint before leaving the shop.

The engines of the circulating pumps and the dry vacuum pumps are to receive a filler, be rubbed smooth and then finally painted.

SPECIFICATIONS

Accompanied by Drawings for

Four Surface Condensing Equipments

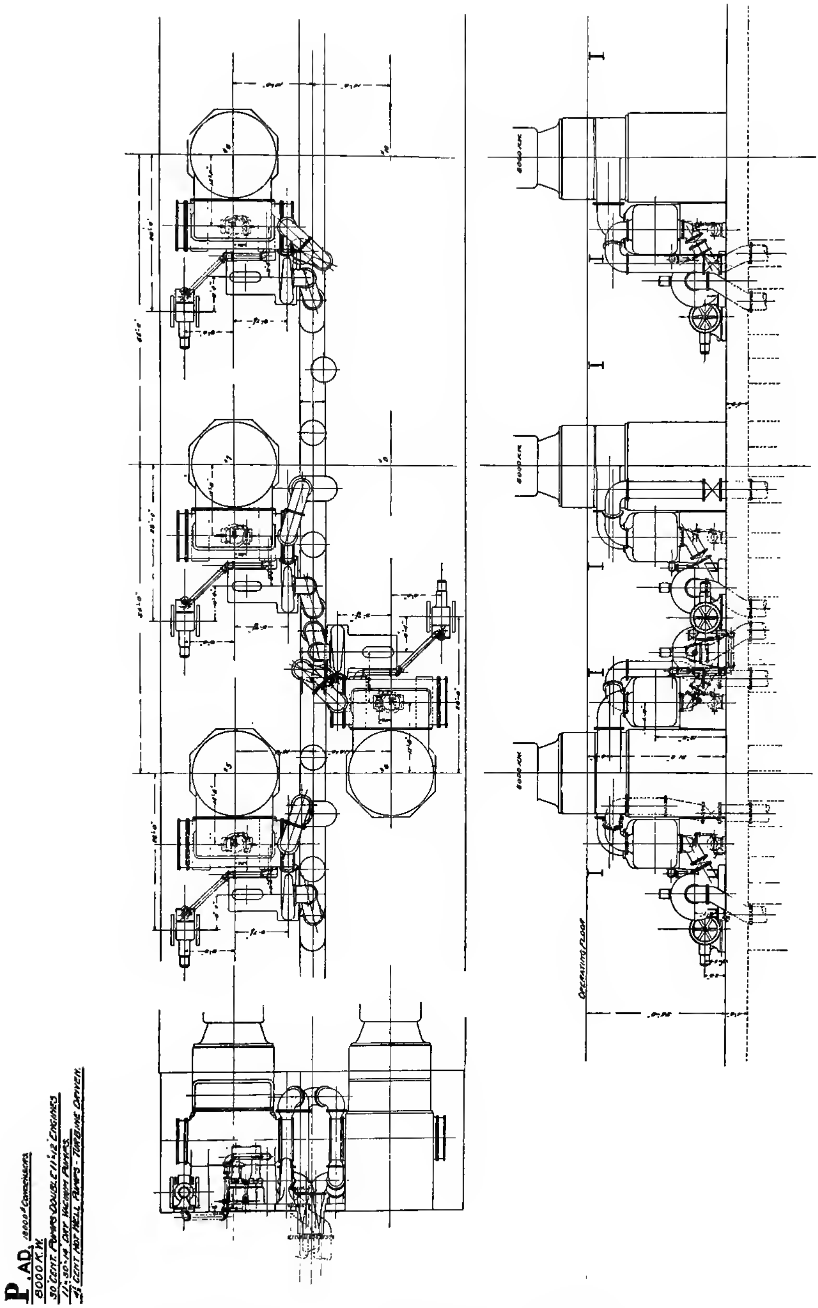
for the new Waterside Power Station

Being a part of the contract dated October 12, 1906, between the Wheeler Condenser & Engineering Company, Contractors, and The New York Edison Company.

1, DESCRIPTION—Of one equipment:

CONDENSER:

The condenser is to be of the Wheeler dry-tube type with a minimum of 18,000 square feet of cooling surface, with provision permitting the later installation of additional cooling surface up to 24,000 square feet if necessary. It is to have ample steam space at the point of entry of the exhaust steam to insure uniform distribution thereof throughout the tube space, and it shall be capable of condensing continuously 180,-000 pounds of steam per hour and maintaining uninterrupted-ly, while so doing, a vacuum of 28 inches, with circulating water at the temperature not exceeding 70 degrees Fahren-heit and a barometer reading of 30 inches.



GENERAL LAYOUT WHEELER CONDENSER.

The body of the condenser is to be rectangular in form and in three parts. It is to be of a high grade of close-grained cast iron and of proper design and thickness to satisfactorily resist external atmospheric pressure and, in general, for its intended purpose.

It is to be provided with suitable feet so arranged as to permit of its resting upon piers, columns, beams or other supports as will be installed for that purpose by this Company.

The inlet and the outlet for the circulating water shall have diameters of 30 and 36 inches respectively and their nozzles shall be so arranged as to permit of the removal of the bonnets without disturbing the piping.

A suitable opening in proper position on the side of the shell is to be left for connection of the condenser to the dry vacuum pump. This opening is to be provided with a suitable internal shield to prevent water of condensation from reaching the pump.

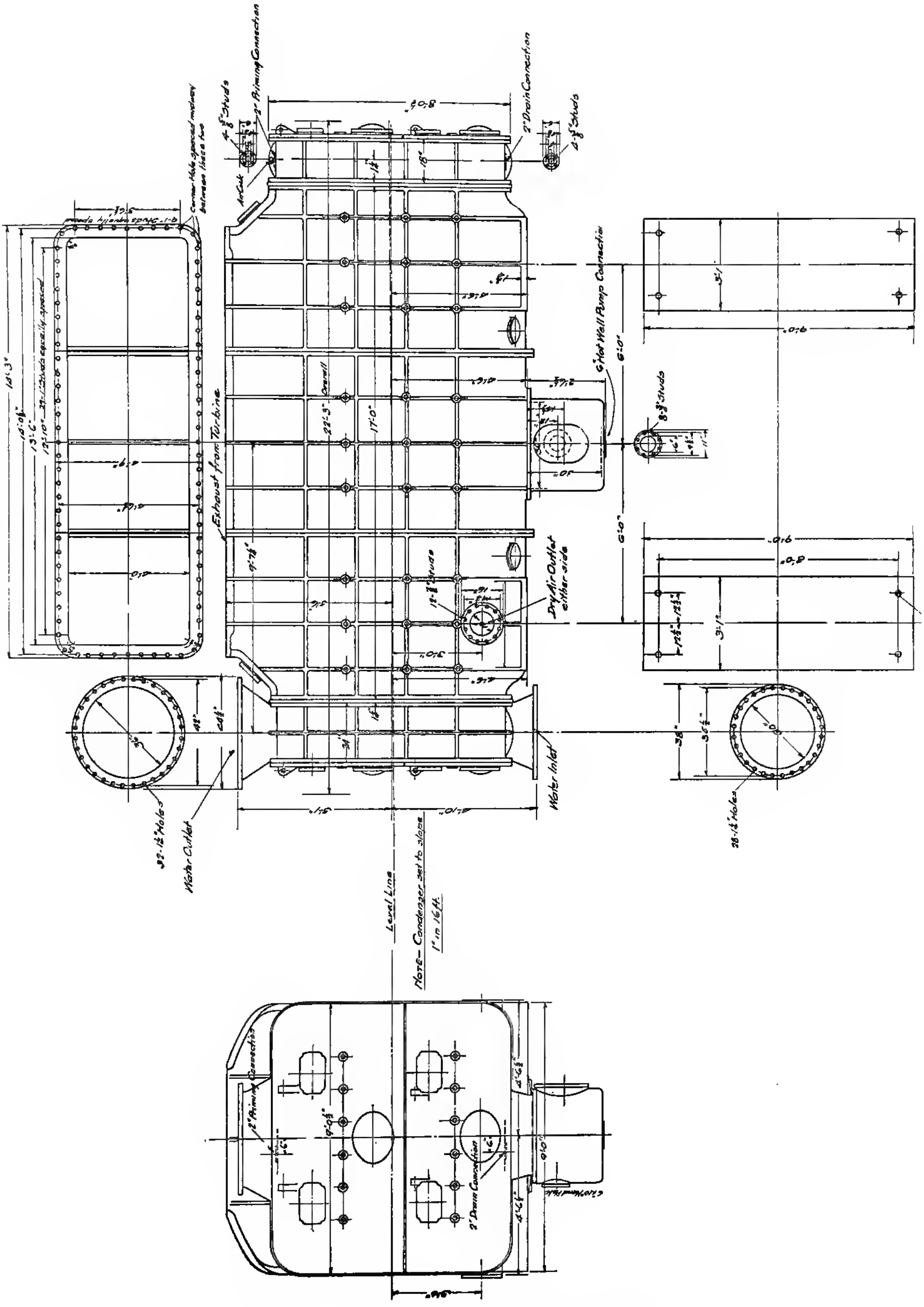
The bonnets and covers of cast iron shall have suitably placed openings with man-hole plates, to allow of interior access without removal of the bonnets or covers.

The hot well is to be located at the bottom of the condenser body to collect the water of condensation and to it the suction of the hot well pump is to be connected.

Suitable baffle plates of cast iron are to be provided and so arranged as to efficiently distribute the exhaust steam throughout the condensing space and at the same time to drain off the water of condensation. Two support plates of cast iron are to be placed in the shell to support the tubes against the impact of the ingoing steam and their own weight.

Water boxes of a high grade of close-grained cast iron and of suitable design, and so arranged that the circulating water will pass twice through the condenser shall be provided at each end of the condenser. Connection will be made at the top of the water box with the dry air pump and also an air ejector for priming the water system.

The tubes are to be uninterrupted, straight lengths of the best



DETAIL OF SHELL, WHEELER CONDENSER.

quality seamless-drawn brass tubing, #18 B. W. G., ¾″ O. D., of a composition of 60 parts copper to 40 parts of zinc, without upsets or flanges and untinned; and, during the operation of the condenser, all of the outer surface of each tube, except where enclosed by the stuffing boxes and the supporting plates, is to be in effective contact with the steam to be condensed.

Suitable stuffing boxes are to be provided in the tube heads for the ends of the tubes, and through which boxes the tubes are to pass, with sufficient projection to permit of proper packing.

Each stuffing box is to be provided with brass ferrule screwed into the head, and having an inner projection or lip to secure the tube in position by limiting its "creeping," and at the same time, allow freedom for expansion and contraction. This stuffing box is to be of such design as to ensure easy insertion, removal and packing of the tubes.

The packing is to consist of fibre, corset lacing, impregnated with paraffine or such other packing as is approved by the Engineer.

All bolts in contact with the water are to be of composition with composition nuts.

The tube heads are to be of the best quality composition and 1⅝″ thick.

A blow-off or drain with flanged valve is to be provided.

Circulating Pump:

The circulating pump is to be of the horizontal shaft volute type having a single side suction and enclosed impeller. It is to be capable of delivering the necessary quantity of circulating water for the efficient operation of the condenser.

The suction opening and the discharge opening are to have respective minimum diameters of 32 inches and 30 inches.

All parts are to be of proper proportion to withstand all stresses incident to normal service. The side plates are to be removable, making a male and female fit with the casing, and fastened by suitable bolts. The general design is to be

such as will permit of the removal of the internal parts without entirely dismantling the pump.

The impeller is to be of the enclosed type. It is to be of cast iron in one piece finished and have a single side suction, and a balancing chamber—reducing the end thrust to a minimum. The impeller casting when mounted, with all moving parts, on the shaft, is to be in perfect rotative balance.

The shaft is to be forged steel, bronze covered and it is to have bearing carried on a bracket extended from the side plate, and a proper stuffing box and gland.

The bearing is to have lignum vitae lining in strips between which freedom of flow of the circulating water is to be permitted.

A thrust chamber, connected by means of suitable piping with the water under pressure on the discharge side of the pump, is to be provided. The shaft is to be machined and accurately ground to size and of careful fit in its bearing, and provided with a shoulder against which the impeller casting will be held by means of a nut on the suction side.

The casing is to be provided with a boss, drilled tapped and plugged for the attachment of an air ejector.

Engine for Circulating Pump:

The circulating pump is to be operated by a direct connected steam engine. This engine is to be of the vertical two-cylinder, simple, non-condensing, semi-open marine, high-speed type. It is to be of such capacity that when run at its normal speed of 225 R. P. M., with 175 pounds steam pressure at 100 degrees of superheat, the circulating pump will deliver to the condenser the necessary quantity of circulating water, with ample over-load capacity.

The cylinders are to be of a selected close-grained cast iron as hard as can be machined and of a diameter of 12 inches and a stroke of 12 inches and have walls of sufficient thickness to allow re-boring twice.

The steam chests are to be located on the side of and integral with the cylinder casting. Bushings are to be fitted and securely fastened in each end of each steam chest to receive the valves, which are to be of the piston type and one-piece castings. The valves are to be balanced under all conditions of operation and they and the bushings are to be accurately ground to size and have metal-to-metal fits; the port edges of the bushings are to be machine finished.

The steam piston is to be of the box type and fitted with snap rings.

The steam inlet and the exhaust outlet are to be 4 inches and 5 inches in diameter respectively.

The frame of this engine is to be of the semi-open marine type with back leg and front columns; the later is to be of forged steel and machined and polished.

The crossheads are to be one piece castings of open hearth steel fitted with adjustable cast iron wedge slippers to take up the wear.

The crosshead guides are to be integral with the back leg casting of the engine frame and of the bored type.

The piston rods and the connecting-rods are to be steel forgings machined and polished over; the crank-pin ends of the latter being fitted with boxes of the marine type, and the cross-head ends with solid boxes, provided with side wedge adjustment for wear.

The piston rods are to have "U. S. Metallic" or other approved packing.

The crank shaft is to be of one piece steel forging, with the center lines of the cranks 90 degrees apart and fitted with a flywheel of suitable proportions and a proper flange coupling. Oil deflecting rings shall be turned on the shaft to prevent the escape of oil from the ends of the bearings and it shall be machined and accurately ground to size and of careful fit in its bearings.

The cranks are to be counter balanced by suitable weights firmly secured to their cheeks.

There are to be four main bearings, properly babbitted, peened and accurately fitted to their respective journals. The lower half-boxes or shells are to be removable without displacement of the crank shaft.

The engine bed shall be of proper design, well ribbed and braced, with seats for the main bearings and provided with a raised lip around the edge to lead off oil and water wastage to a proper receptacle in the bed-casting, whence it is to be finally drained through a suitably located and tapped opening.

A suitably designed extension of the base of this bed-casting shall be provided for the circulating pump; and there shall be included a neat and substantial platform and ladder, provided with proper railings of solid and polished wrought steel stanchions and polished brass tubing, iron pipe size.

Turbine Hot Well Pump:

The hot well pump is to be of the horizontal-shaft, duplex volute type, having a side suction and enclosed impeller. The pump is to be capable of delivering, against a total discharge head of 25 feet, 500 gallons per minute from the hot well in which is being maintained a vacuum of 28 inches.

The suction opening and the discharge opening are to have minimum diameters of 4½ inches and 4½ inches respectively.

The suction connection is to be of special form and provided with a vapor pipe inlet to the condenser shell and the pump is to be of such design as to permit of the removal of all internal parts without entirely dismantling it.

The impellers are to be of the enclosed type, cast iron, in one piece and have a single side suction and a balancing chamber.

The shaft is to operate in outboard babbitted bearings carried on brackets extended from the main casings. The shaft is to have the necessary and proper stuffing boxes and glands; and thrust chambers, connected by means of suitable piping with the water under pressure on the discharge side

of the pump, are to be provided. The shaft is to be a steel forging, machined and accurately ground to size, and provided with a shoulder against which the impeller casting will be held by means of a nut.

The hot well pump is to be operatel by a "Terry" steam turbine which the Contractor is to furnish.

DRY VACUUM PUMP:

The dry vacuum pump is to be steam driven and of the single, horizontal, center-crank, rotative type.

The steam cylinder is to be of a diameter of 12 inches; the air cylinder is to be of a diameter of 30 inches; both cylinders are to be of a stroke of 14 inches and have walls of sufficient thickness to allow re-boring twice.

The steam inlet and the exhaust outlet are to be 3 inches and 3½ inches in diameter respectively.

The air cylinder is to have a water jacket which shall completely surround it and its heads; the coring to be so arranged as to insure the most thorough and effective circulation of the cooling water. The construction of the heads and of the housing is to be such that all of the air joints may be broken and renewed without disturbance of the other parts.

The cylinders are to be of a selected, close-grained cast iron as hard as can be machined and they are to be bored true and smooth and the air cylinders provided with the proper connections for the water jackets.

The steam cylinder is to be equipped with two relief valves and drilled and tapped for drains, indicator connections, etc., and lagged with 85 per cent. carbonate of magnesia which is to be covered with Russia iron held by polished brass bands. All indicator riggings for both cylinders are to be furnished.

The steam chest is to be located on the side of, and integral with, the cylinder casting. Bushings are to be fitted and securely fastened in each end of the steam chest to receive the valves, which are to be of the piston type, and one piece castings of a selected close-grained iron as hard as can be ma-

chined. The valves are to be balanced under all conditions of operation and they and the bushings are to be accurately ground to size and have metal-to-metal fits; the port edges of the bushings to be machine finished.

The air valves for suction and discharge are to be respectively of the "D" semi-rotary and lift types; the former to be operated by a separate eccentric on the main crank shaft and free to lift for ample water relief, and provided with flash ports for connecting both ends of the cylinder at the end of each stroke thus equalizing the pressure in the clearance spaces with that in the condenser; and the latter moving vertically in guides of liberal surface and held by phosphor bronze spiral springs to bored seats in the cylinder casting. The air valves for suction control are to be accurately ground to air-tight contacts with their seats.

The steam and air pistons are to be of the box pattern, the former fitted with snap rings and the latter provided with "Wheelock" segmental packing rings and connected to the crosshead by two rods passing through water sealed stuffing boxes. . The air piston is to be further provided with bearing rings cast thereon of "Allen" or other suitable anti-friction metal.

All clearances are to be of minimum volume; the heads and the pistons being faced to insure this.

The frame of the air pump is to be a heavy and substantial casting with a bearing located on each side of the crank.

The crosshead is to be of open hearth cast steel and furnished with cast iron wedge slippers adjustable for alignment and wear.

A single, center, connecting rod shall connect the crosshead to the crank shaft. It and the three piston rods shall be steel forgings with the crankpin end of the former, fitted with a box of the marine type and the crosshead end with one of the solid type provided with side wedge adjustment for

wear; both boxes properly babbitted and the rods machined and polished all over.

The crank shaft is to be a one-piece steel forging and fitted with two flywheels of suitable proportions and sufficient weight to permit of running at a slow speed for light duty. They are to be keyed to the shafts and have rims of square cross-section, turned true and faced on their sides.

Oil deflecting rings shall be turned on the shafts to prevent the escape of oil from the ends of the bearings.

CONNECTIONS AND EXPANSION JOINT:

An appropriate exhaust steam elbow or expansion joint, intermediate of the turbine and the condenser, is to be furnished, of such design that the condenser will have an approximate pitch of 1 inch in 17 feet, thus allowing the tubes to drain.

All the necessary air and water connections of sizes and forms to comply with local necessities are to be included in the herein specified condensing equipment.

FIXTURES:

All the usual and necessary fixtures throughout shall be furnished by the Contractor for each condensing unit, including a "Waters" throttling governor for the engine of the circulating pump and a like appliance for the steam end of the dry vacuum pump, positive feed, sight-feed lubricators, hand oil pumps, grease and oil cups, cylinder relief valves, cylinder drain cocks or valves, the vacuum and pressure gauges and the thermometers and their wells as hereinbefore specified and a complete set of drop forged wrenches.

The gauges and the thermometers and their wells are to be of Hohmann & Maurer make.

All material and workmanship are to be satisfactory to the Engineer.

14. Test:

The condenser tubes are to be subject to an internal cold, hydrostatic pressure test of 500 pounds per square inch.

Acceptance tests of the condensing units shall be made prior to the final payment therefor; these tests to be conducted by representatives of the Company and the Contractor on such lines as shall be later determined.

15. Erection:

The Contractor is to do all of the erecting of the apparatus herein specified to be furnished by him; supplying all material and necessary appliances therefor except the foundations, leaving all joints absolutely tight against leakage, and installing complete and satisfactory equipments ready for service and in accordance with the intent of these specifications.

The Company will supply and erect the necessary foundations, supports and anchor bolts leaving the same ready for reception of the herein specified equipments. It will also supply the suction connections from the circulating water wells to the nozzles of the circulating pumps and the discharge connections from the discharge nozzles of the condensers to the discharge wells; and all steam, exhaust and drip piping for the engines of the circulating and dry vacuum pumps.

A travelling crane, with a capacity of fifty tons, will be in service in the station, and may be used by the Contractor for erecting the herein specified equipment.

16. Guarantees:

The Contractor guarantees that each condensing unit will continuously condense 180,000 pounds of steam per hour and uninterruptedly maintain a vacuum of 28 inches as read by a mercury column; or that it will continuously condense 220,000 pounds of steam per hour and uninterruptedly maintain a vacuum of 27½ inches as read by a mercury column; each guarantee being referred to an intake temperature of the

circulating water of 70 degrees Fahrenheit and a barometric reading of 30 inches. These guarantees are also conditioned on all apparatus not furnished by the Contractor being substantially tight and free from air leaks.

Should these guarantees fail to perform with a cooling surface of 18,000 square feet, the Contractor is to install additional cooling surface until the terms of his guarantees are met, up to and including a total cooling surface of 24,000 square feet for each condensing unit. A failure to meet these guarantees with 24,000 square feet of cooling surface will be sufficient cause for rejection of the apparatus.

The Contractor further agrees that all auxiliary apparatus of each unit will be ample capacity for its purpose as initially installed by him, and that the equipments throughout will be efficient and satisfactory appliances for their intended purposes under the conditions hereinbefore stated; and he further guarantees for the term of one year all material and workmanship entering into their construction and within that time will replace, without charge therefor, any imperfect part.

PAINTING:

Before leaving the shop and after inspection by the Engineer, the exteriors of the condenser bodies and of the casings of the pumps are to receive a coat of filler and a finishing coat of paint, and their interiors two coats of an anti-rust metallic paint; and the engines of the circulating pumps, and the dry vacuum pumps are to receive a filler, be rubbed smooth, and then finally painted.

The painting shall not in either or any case be done until after the castings have been inspected by the Company's representative.

SPECIFICATIONS

Accompanied by drawings for the

PIPING

of the New Waterside Power Station.

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York,

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HIGH PRESSURE PIPING.

PIPE:

All pipe is to be full weight wrought steel of the best quality obtainable.

All bending is to be done by skilled workmen. Workmanship is to be equal to the best standard applied to this class of work. All pipe is to be perfectly clean and free from scale, inside and outside, when delivered.

FLANGES:

All flanges for steam and feed water are to be the Van Stone or similar pattern of rolled steel of the design and proportion shown on table on blueprint 14281. The faces, backs and inner surfaces of the steel flanges are to be given a tool

finish. Flanges of the pipe are to have fine tool finished face and are to be of the full diameter specified. The thickness of the turned-over portion of the flange is to be the same as the thickness of the pipe. The backs and the turned-over portion are to be finished parallel to the face.

TEST:

Each piece will be carefully inspected and tested with 400 lbs. hydraulic pressure. Any unsatisfactory or defective piece will be rejected.

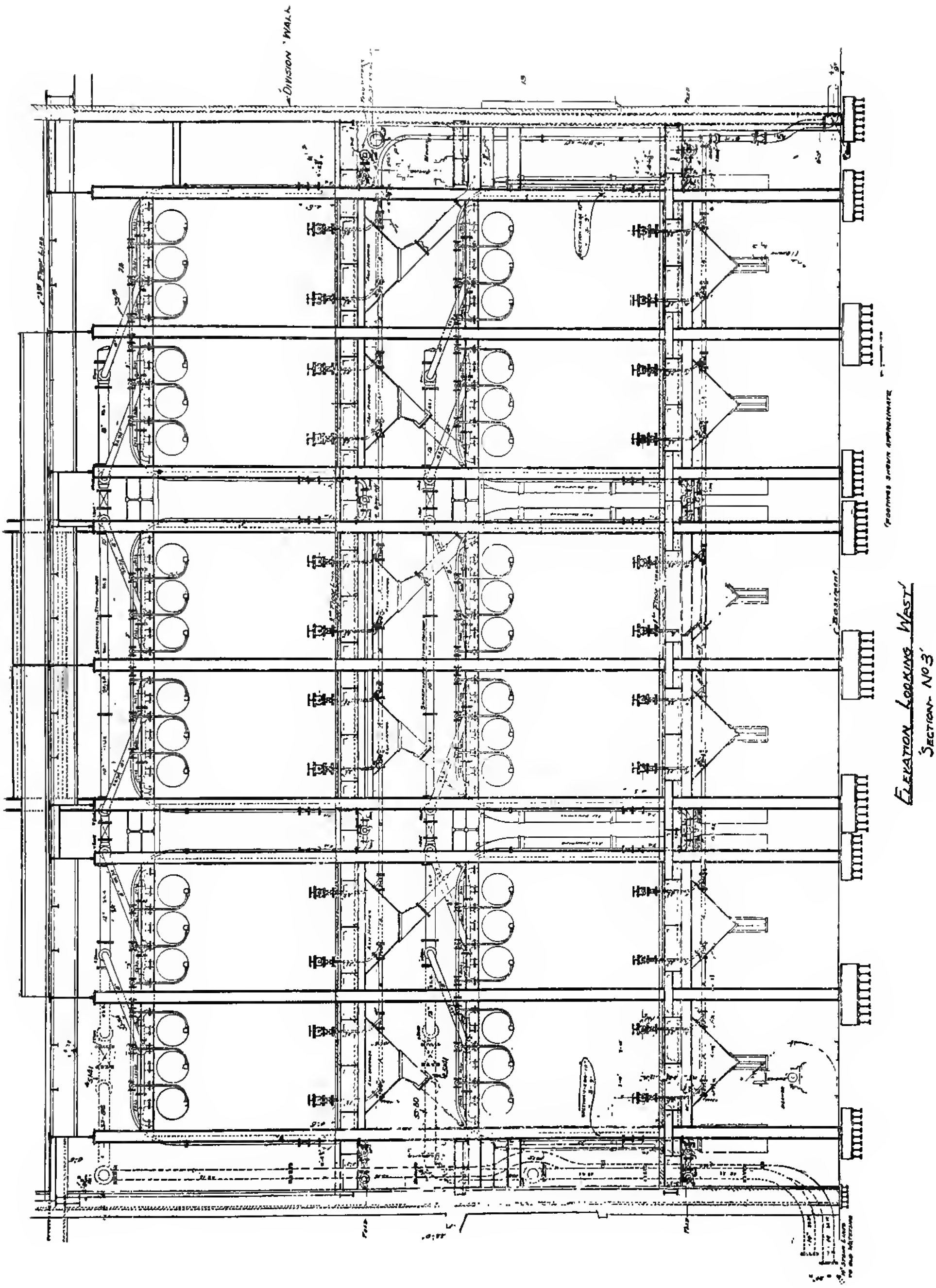
HIGH PRESSURE FITTINGS.

DESCRIPTION:

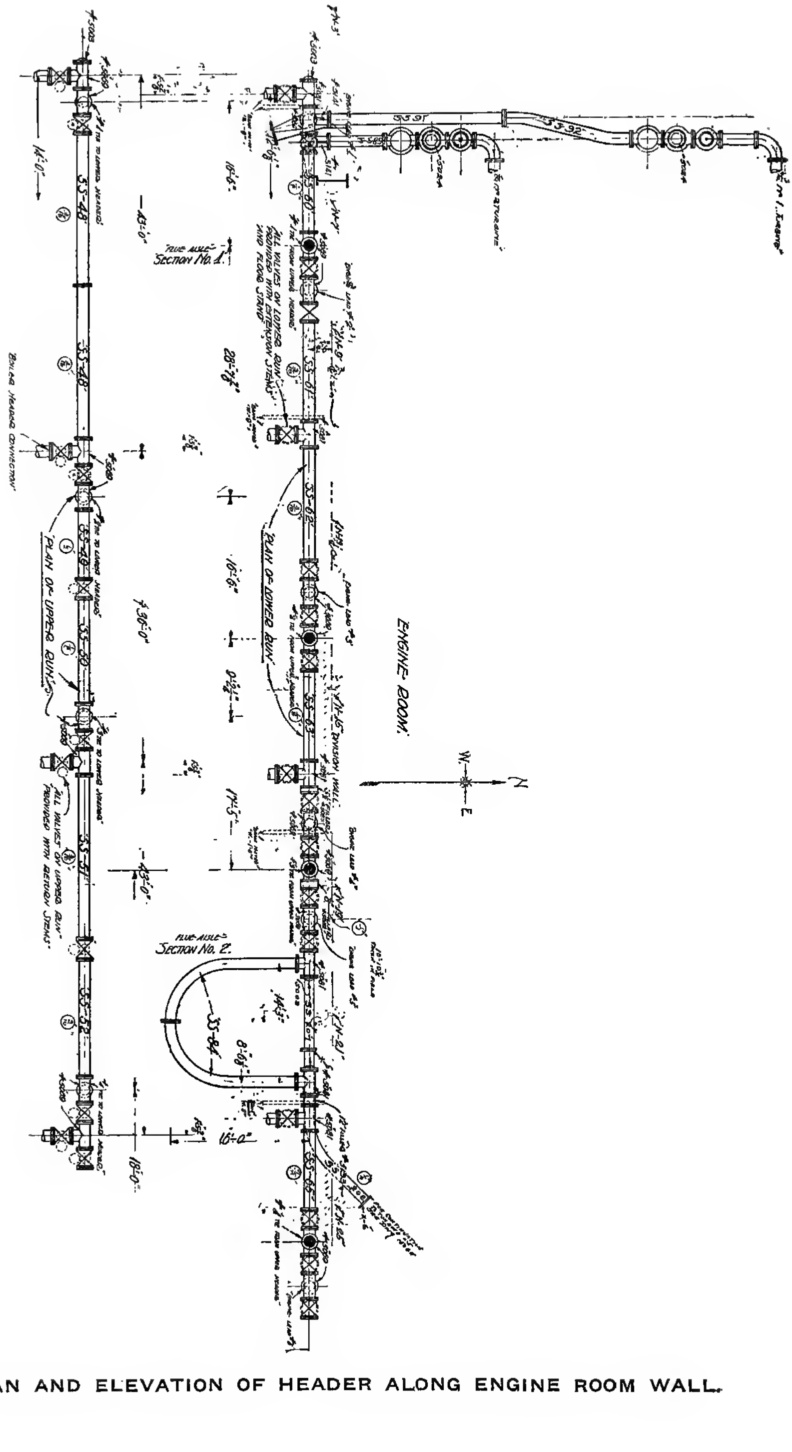
All material is to be of ample strength and durability for 200 lbs. steam pressure with 100° F. of superheat. All castings are to be made of a superior grade of open hearth cast steel by either the Penn Co. or the Baldt Co. Steel is to have a tensile strength of at least 60,000 lbs. per sq. in. and all castings are to be annealed. They are to be sound, free from injurious roughness, sponginess, pitting, cracks or other defects. No plugging of holes will be allowed. Thickness of body, flanges and drilling to conform to the table given on the accompanying drawing.

All bolt holes are to be drilled per template (not cored) and are to be evenly and accurately spaced so that valves of the same size will be interchangeable. Flanges are to be truly and accurately faced for ground joints and are to be parallel. Backs of flanges are also to be finished in the same manner. No bolt or stud smaller than ¾" is to be used except on the stuffing boxes of the by-pass where ⅝" bolts may be used. If gaskets are used between the bonnet and body, they are to be of a material which will withstand the action of steam at the pressure and temperature given above.

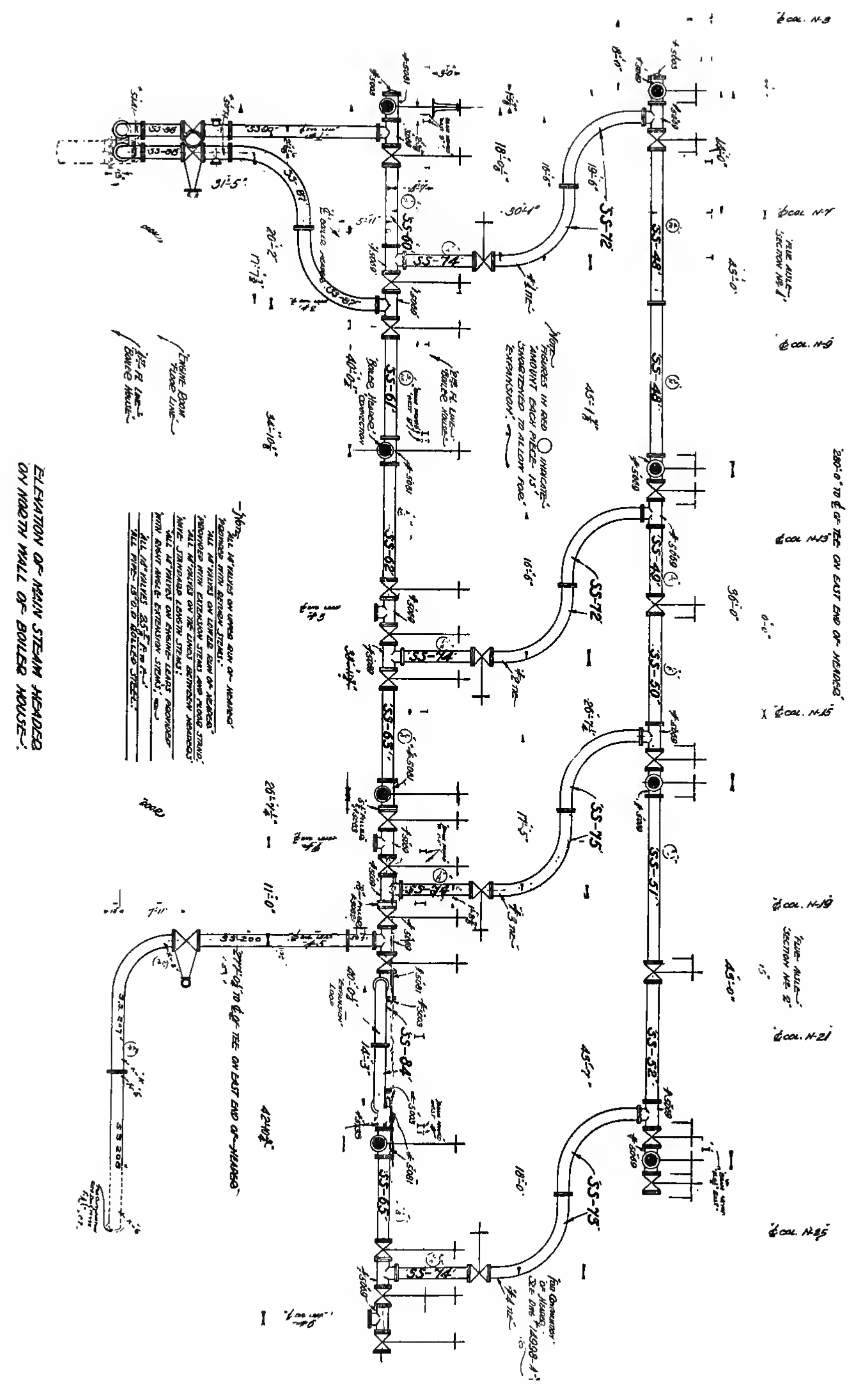
Valves are to be tested with 400 lbs. hydraulic pressure



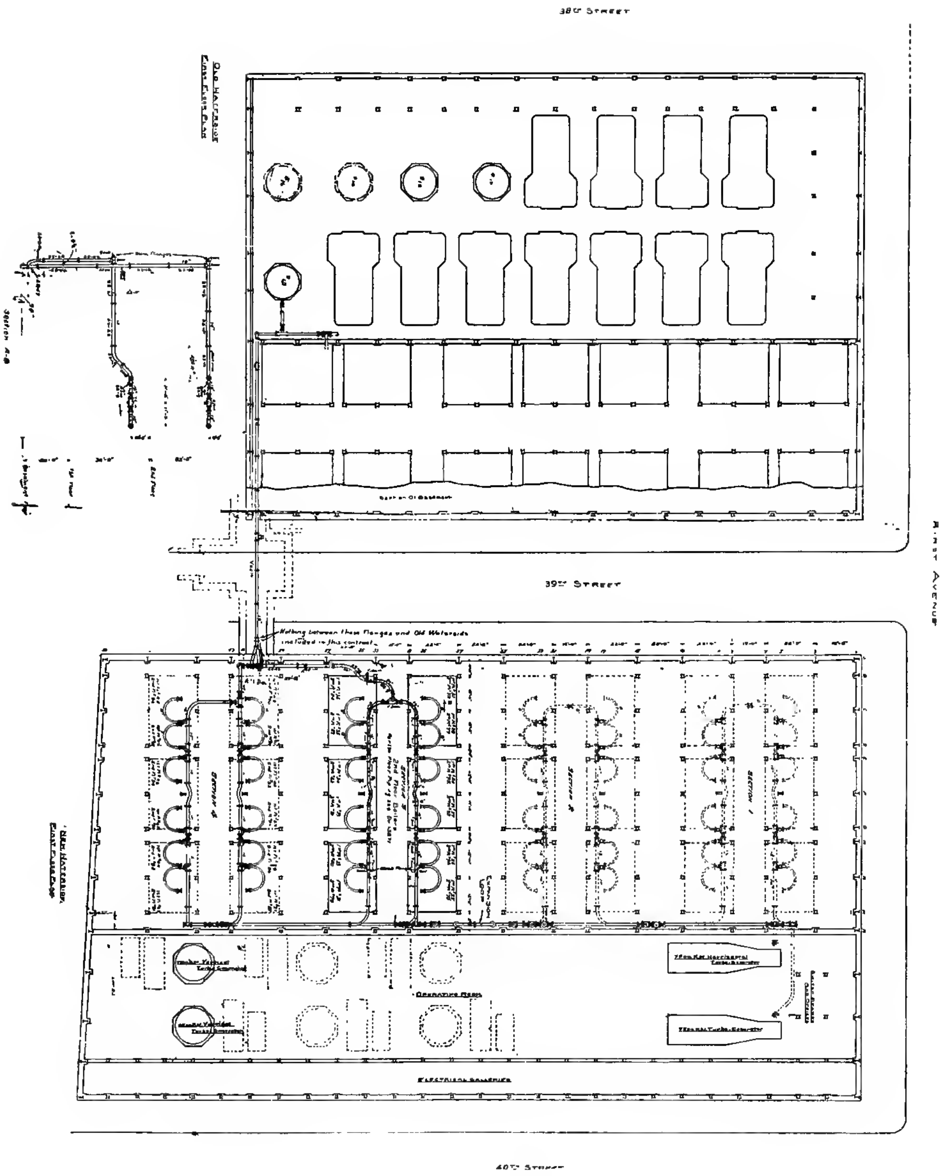
WEST ELEVATION MAIN STEAM LINES IN BOILER HOUSE.



PLAN AND ELEVATION OF HEADER ALONG ENGINE ROOM WALL.



ELEVATION MAIN STEAM HEADER ON NORTH WALL.



GENERAL PLAN OF STEAM MAINS SHOWING TIES TO WATERSIDE NO. ONE.

and will be tested by the Company after erection with 200° steam pressure and 100° F. of superheat.

COMBINATION STOP AND CHECK VALVES.

DESCRIPTION:

The construction of this type of valves is to be such that it will automatically open when the pressure on the boiler to which it is attached equals that in the line, and automatically close when the pressure falls below that in the line; the valve to remain positively open or closed until acted upon, as intended, by variation of pressure, as before specified, to assume the opposite position; all chattering of the disc against its seat or elsewhere is to be absolutely prevented.

Stems are to be provided, so constructed that when non-automatic action of the valves is desired they can be either opened or closed, or left free for automatic operation.

A suitable indicator is to be provided for the stem of each valve to show its open, closed, and automatic positions.

The valves are to have geared, return stems, with the usual hand wheels; as shown on accompanying blue print of drawing No. 13955.

MATERIAL:

The material is to be of ample strength and durability for a steam pressure of 200 lbs. per square inch, with 100° Fahrenheit of superheat.

The body and bonnet castings are to be of a superior grade of open hearth, crucible, or Bessemer steel; of a tensile strength of from 55,000 to 65,000 lbs., per square inch; an elongation in 2″, on a test specimen to be cast on the body of a valve, of 20 per cent.; a contraction of area of 30 per cent.; a maximum percentage each of sulphur and phosphorous of .05; and a capacity to satisfactorily stand bending around 1″ radius, and through 120 degrees; and annealed.

All of the cast steel parts of the valves herein specified to be furnished are to be made from the same blow or heat as the one from which the test coupon is to be taken.

Two or more valve bodies should have the test coupons cast thereon, to allow for flaws developing in the coupons.

Castings must be true to the pattern and free from blemish, flaws, or shrinkage cracks.

If found to be porous in any part, they will not be accepted.

FINISH:

The drilling and thickness of the bodies and flanges of the valves are to conform to the table given on the accompanying blueprint of drawing No. 14317.

All bolt holes are to be drilled to template, not cored, and are to be evenly and accurately located so that valves of the same size will be interchangeable.

Bolts smaller than ¾"diameter must not be used.

The flanges are to be truly and accurately faced with fine tool finish for gaskets, and are to be at right angles with each other. The backs of the flanges are also to be faced.

The joints between the bodies and the bonnets of the valves are to be made up with corrugated gaskets of steel or Swedish Iron No. 28 B. W. G.

All gear wheels and pinions are to have cut teeth.

All valve stems are to be of steel.

All castings are to be absolutely free from scale and core sand and facing sand, and delivered unpainted.

The construction of the valves must be such that there will not be any binding of any of its parts under any normal conditions.

TEST:

Each valve is to be subjected by, and at the expense of, the Contractor, in the presence of a representative of this

Company, to a shop hydrostatic test of 400 lbs. per square inch, which test is to be satisfactory to the representative.

After erection, the valves will be tested by the Company with a steam pressure of 200 lbs. per square inch, with 100° Fahrenheit of superheat, and any valve showing signs of weakness, leakage or other defect may be condemned by this Company's Engineer.

ERECTION:

This Company will do all erecting of the herein specified valves.

DELIVERY:

All of the valves herein specified to be furnished are to be delivered with all parts liable to damage by rust, abrasion or other means, protected against it; the outside faces of the flanges to be, in addition, shielded by wooden discs bolted thereto.

All of the material herein specified to be furnished is to be delivered at this Company's Waterside Station No. 2, First Avenue, 39th & 40th Streets, and the East River, Borough of Manhattan, City of New York, or at such point in the immediate vicinity as may be later directed, and as per the following schedule:

On or before June 1, 1906..............Twenty-four valves
At intervals up to December 1, 1906......Forty-eight valves

STEAM SEPARATORS.

There are to be 53 of these separators as per the following list:

SIZE.	REQUIRED.	POUNDS STEAM PER HOUR.
2″	Two (2)	6000 each
2½″	Ten (10)	Two at 3000 ea., 8 at 4000 ea.
3″	Two (2)	3000 each
3½″	Twenty-four	3000 each
4″	Ten	Two at 7000 ea., Eight at 13000 ea.
4½″	Two (2)	9000 each
5″	Two (2)	9000 each
6″	One (1)	6000 each

They are to be of the horizontal run non-receiver type for a working pressure of 200 pounds per sq. in. with 100 degrees Fahr. of superheat, and a capacity to deliver the foregoing respective weights of steam in pounds per hour.

MATERIAL:

All parts of 5″ and 6″ separators which are to be subjected to the working pressure are to be made of cast steel of which the Contractor, in his proposal is to state the chemical and physical properties. The other sizes are to be of close even grain cast iron.

FINISH:

All castings are to be smooth and of uniform soundness, free from blow holes, cold shuts, cracks or other defects; absolutely free from all core sand and facing sand before assembling, and delivered unpainted.

The lowest point of the body of each separator is to be provided with a boss tapped for a drain connection of suitable size, and on the proper locations at the side of the body, bosses are to be provided suitably tapped and plugged for the later attachment of glass water gauges if so desired.

The diameter ("A") thickness ("L") and drilling of the flanges, for the main steam connections are to be as given on our drawing No. 14281; a blue print of which accompanies this specification. The faces of the flanges are to have fine tool finish for

gaskets and the backs of the flanges are to be similarily finished.

All bolt holes are to be drilled to template; not cored.

TEST:

Each separator is to be subjected, by and at the expense of the Contractor, in the presence of a representative of this Company, to a shop hydrostatic test of 400 lbs., which test is to be satisfactory to the representative.

After the erection, the separators will be subjected to service test with the before mentioned service steam pressure of 200 pounds per square inch, and should any separator or part thereof show signs of weakness, leakage or other defect, it will be condemned by this Company's Engineer and must be made good by and at the expense of the Contractor.

ERECTION:

This company will do all of the erecting of the equipment herein specified to be furnished by the Contractor and will supply the companion flanges.

DELIVERY:

All of the equipment herein specified to be furnished by the Contractor is to be delivered where hereinbefore specified or at such a point in the immediate vicinity as may be later directed and as per the following schedule.

Within one week after receipt of order therefor:

8—2½″
1—6″

On or before May 1, 1906.

4—4″
2—4½″

Between May 1, and June 1, 1906.

8—3½″

Between June 1, and July 1, 1906.

8—3½″

4—4″

Between July 1, and August 1, 1906.

2—2″

2—2½″

8—3½″

2—4″

Between August 1, and September 1, 1906.

2—3″

2—5″

GUARANTEE:

The Contractor is to guarantee that each separator will satisfactorily perform its intended purpose of thoroughly preventing the passage by it of all entrained water in the steam, and that it will safely and fully take care of all sudden excessive and abnormal rushes of water commonly called "Water Slugs."

In addition to the foregoing requirements, he is to guarantee all separators and parts thereof against defective material and workmanship for the term of one year from the dates of their acceptances.

BLOW-OFF PIPING.

DESCRIPTION:

For the purpose of this specification, there are to be 72 boilers equipped with blow-off connections; and the necessary system of piping therefor is to be installed as per our drawings Nos. 13973—elevation looking North, 14038—elevation looking West, and 14996—plan.

These boilers are included in sections 1, 2 and 4 of the boiler plant; and our drawing No. 14996 shows the intended arrangement of the blow-off piping for each one of these sections of 24 boilers.

On the mud-drum of each one of the 72 boilers which are herein specified to be piped as stated, two 2½″ screwed outlets are to be provided under the boiler contract. To each one of the 144 outlets which are to be thus provided, the contractor is to connect a 2½″ pipe leading directly to the rear, and to the outside of the boiler setting. Each of these 144 pipes is to be offset, as shown in our drawing No. 14330, and is to have at its outer end a 2½″ angle blow-off valve and a 2½″ blow-off cock. From each one of the 144 blow-off cocks, a 2½″ pipe connection is to be run to the 4″ header, as shown, by means of a continuous pipe bend and the special 4″ x 4″ and 2½″ lateral, or "Y" fitting (No. 5028); which fitting, in each case, as well as other fittings, as later herein specified, will be furnished by us.

There are to be two 4″ headers for each tier of boilers—four of these headers per section—run under the ceilings of the basement and first floor; the former two under the first floor flue aisle and the latter two in the first floor flue aisle. The two 4″ headers for the upper tier of boilers are to be led down separately, near the division wall, receiving, with proper, reducing sweep Tees (No. 5025), the two 4″ headers for the lower tier of boilers as shown on our drawings Nos. 15975 and 14056. From the point of reception of the two lower headers the upper ones are to continue with 45° Ells (No. 5029) as 6″ lines to their junction with the 8″ x 6″ x 6″ "Y" fitting (No. 5027), and whence the system is to be run as 8″ to, and including, the 8″ Ell (No. 5030) which is shown on our drawings Nos. 13073 and 14056, from which point the blow-off system is to be extended under another specification.

MATERIAL:

The connections between the mud-drums and the blow-off valves are to be of extra heavy brass pipe with extra heavy brass flanges. All other piping of the blow-off system is to be of wrought steel and full weight; except the bends K, K1 and L which are to be extra heavy.

All gaskets are to be of copper or other approved material. Hanger details are shown on drawing No. 14508.

FINISH:

The flanges of the brass connections between the mud-drums and the blow-off valves are to be ground to form steam and water tight joints. All other flanges of the blow-off system are to be faced with fine tool finish for gaskets.

All flanges are to conform to the table of details given on our drawing No. 14950. All bolt holes are to be drilled to template, not cored. All piping, as far as consistent with the standard of best practice, is to be clean and smooth inside and outside and free from all dirt and scale before erection.

All threads are to be clean, full and perfect, and all material and workmanship are to be satisfactory to this Company's Engineer.

ERECTION:

The Contractor is to do all of the erecting of the material herein specified to be furnished by him, supplying all hangers, bolts, gaskets, etc., needed for the proper installation of the equipment. The locations of the hangers are indicated on the drawings by the letter "H" followed by a figure or figures.

The individual boiler connections to the 4" headers are shown on our drawing No. 14996 in both solid and dotted lines; the latter indicates the intended manner of connecting the boilers of the second tier.

The Company will furnish to the Contractor all of the valves and cocks and all of the fittings and the floor and wall sleeves called for by the system of blow-off piping shown on our drawings.

All the work of erection is to be done under the supervision of our Superintendent of Construction or his representative, and his directions are to be followed in all matters relating to the methods and appliances to be used by the Contractor in connection therewith.

DELIVERY:

All of the material herein specified to be furnished by the Contractor, is to be delivered where hereinbefore stated, or at such point in the vicinity as may be later directed, and installed as a complete equipment, in three divisions of completion of 24 boilers each, each division to extend and include the 8″ Ell as hereinbefore specified, and a complete division by each of the folowing dates:

June 1, 1906
August 1, 1906
September 1, 1906

GUARANTEE:

The Contractor is to guarantee the entire equipment of blow-off piping as herein specified to be installed by him, against defective material or workmanship for one year from the date of its final completion.

BLOW-OFF-FITTINGS.

There are to be 168 bends for blow-off piping, as per the following list and as shown on our drawing No. 14330:

Size.	Mark.	Required.
2½″	K	134
2½″	Kl	2
2½″	L	32
		168

These bends are to be made of extra heavy pipe, National Tube Works Company's standard, and each bend is to be fitted, complete with two extra heavy flanges.

Material:

The bends are to be of the best grade of wrought steel. The flanges are to be of cast iron of a tough gray mixture.

Finish:

So far as consistent with the standard of best practice, the inner and outer surfaces of all of the piping are to be smooth, clean and free from dirt and scale when delivered.

All castings are to be true to the pattern; smooth and of uniform soundness; free from blow holes, cold shuts, cracks and other defects; absolutely free from sand before assembling, and delivered unpainted.

All flanges are to conform to the table of details given on our drawing No. 14280. All bolt holes are to be drilled to template, not cored, and all drilling is to straddle the vertical and horizontal centres. The joint faces of the flanges are to have fine tool finish for gaskets, and the backs of the flanges are to be similarly finished for such area as may be necessary for the proper seating of the heads and nuts of the flange bolts, and all joint faces of the flanges are to be perpendicular to the axes of their respective pipes.

When the flanges have been fully and finally "made on," the ends of the pipes are not to be flush with the joint faces of the flanges, but shall fall slightly short of such length; to the end that the pipe joints will be made only by the flanges.

All threads are to be clean, sharp and perfect.

All material and workmanship are to be satisfactory to this Company's Engineer.

Test:

Each bend, after its flanges have been fully and finally "made on," is to be blanked and subjected by, and at the expense of the Contractor, in the presence of a representative of this Company, to a shop hydrostatic test pressure of 400 pounds per square inch, which test is to be satisfactory to the representative.

ERECTION:

This Company will do all of the erecting of the material herein specified to be furnished by the Contractor.

DELIVERY:

All of the material herein specified to be furnished by the Contractor, is to be delivered where hereinbefore stated, or at such point in the immediate vicinity as may be later directed.

FITTINGS FOR SUPERHEATER BLOW OFF.

The one hundred twenty four fittings which are to be furnished hereunder are, in respective quantities, as per the following:

MATERIAL LIST.

Pattern No.	Wanted.
5396	32
5397	8
5398	4
5399	14
5400	32
5401	24
5448	4
5449	4
Total....	124

MATERIAL:

All of the fittings enumerated in the above list are to be of good grade of close-grained cast iron of a gray mixture.

FINISH:

The joint faces of all flanges are to be raised and have fine tool finish and the backs of all flanges faced for heads and nuts

of bolts; they shall be accurately parallel and perpendicular to each other, where indicated on the drawing to be so; and in all cases truly at right angles to the axes of the different runs.

Bolt holes must not be cored. They are to be drilled to template and in conformity with the details thereof as given on drawing No. 16924.

We will furnish all necessary patterns, and all castings are to be true thereto, uniformly sound, and without cold-shuts, blow-holes, cracks or any other defects, and their entire interior and exterior surfaces are to be free from all foundry sand, chips, filings, etc. and unpainted when delivered.

All material and workmanship are to be satisfactory to our Engineer.

TEST:

Each fitting is to be subjected by and at the expense of the Contractor hereunder, in the presence of our representative, to a shop hydrostatic test of 400 pounds per square inch and which test is to be satisfactory to our representative.

After erection, the fittings will be tested by our Engineer with a pressure per square inch of 200 pounds of steam with 100 degrees F. of superheat, and any fitting showing signs of weakness, leakage, or other defect, may be rejected by him.

ERECTION:

We will do all erecting of the material herein called for, and will supply all bolts and gaskets.

DELIVERY:

The Contractor hereunder is to commence work on the herein specified material immediately on his receipt of our order therefor, and he is to deliver the same where hereinafter stated, or at such point in the immediate vicinity as may be later determined, at the earliest date consistent with reasonably prompt despatch.

FEED PIPE FITTINGS.

16-3″ extra heavy brass and cast iron gate valves, 13½″ length overall.

4-5″ extra heavy brass and cast iron gate valves, 15″ length overall.

38-6″ extra heavy brass and cast iron gate valves, 15⅞″ length overall.

Valves are to be used under 200 pounds hydraulic pressure.

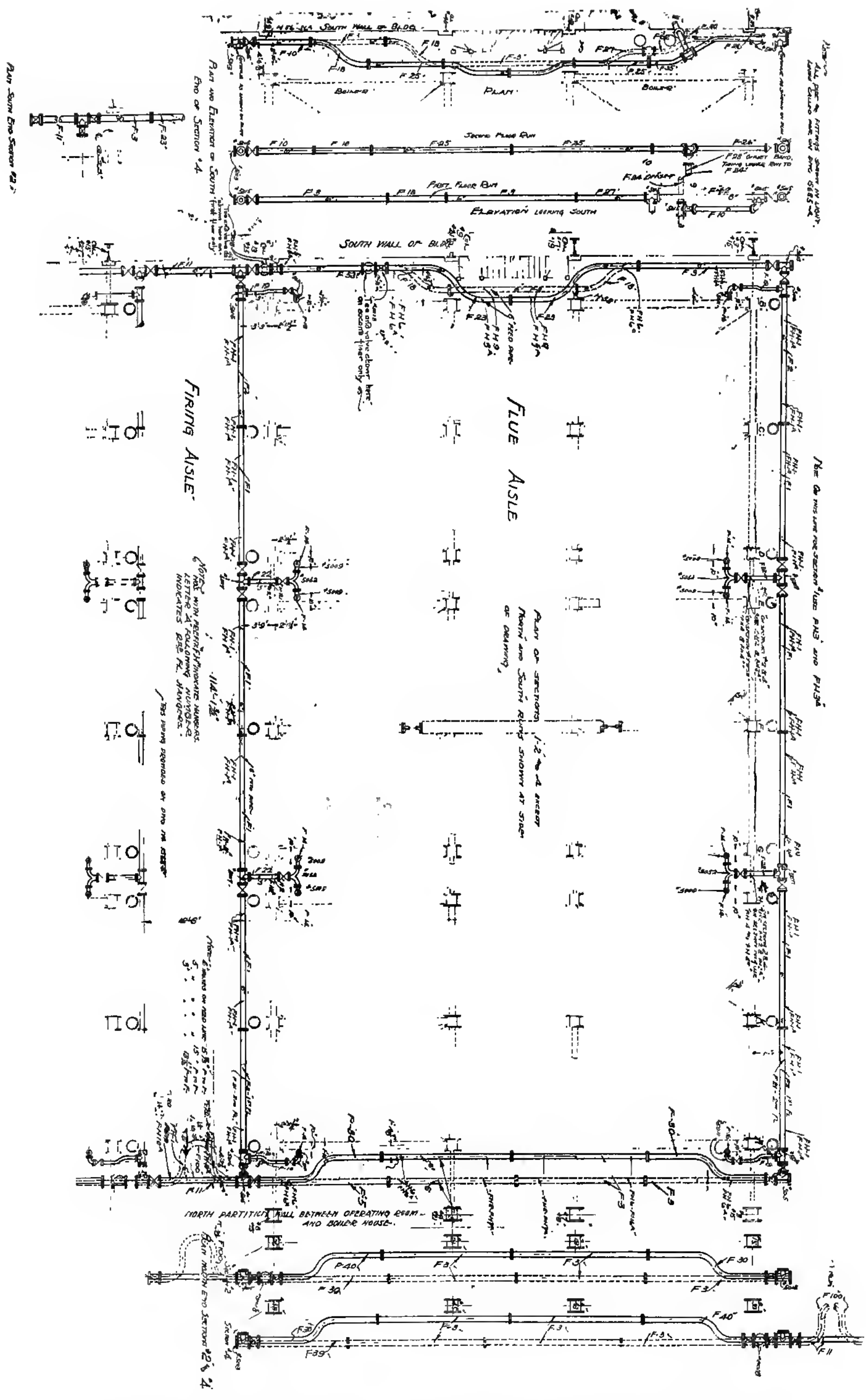
Valves are to have split wedge gate.

The valves are to have cast iron bodies of a superior grade of remelted cast iron, free from all sand or blowholes or imperfections, with body and flange thickness corresponding to drawing 13921, with composition stems.

The faces of flanges on all valves are to have a fine tool finish and are to be drilled as per the table drawing 13921. Holes are to be drilled per template and are to be evenly and accurately spaced so that all valves of the same size will be interchangeable. All flanges are to be chamfered as shown. Backs of all flanges are to be faced or spot bored.

All workmanship is to be first class in every respect.

Valves are to be tested with 400 lbs. hydraulic pressure and any valve exhibiting signs of weakness may be condemned.



PLAN AND ELEVATION OF FEED LINES IN SECTION NO. TWO.

EXHAUST PIPE FITTINGS.

MATERIAL:

All the piping and fittings shown on our drawings and enumerated in the following list are to be of a good grade of gray cast iron, uniform in character.

Patt. No.	Pcs. Required.	Size.	Description.
5155	One	36″	Side outlet pipe.
5156	Two		Bearing plate.
5157	Two	36″	Offset with foot.
5158	Two	36″	Exhaust well cover.
5159	Four	30″	Pipe.
5160	Four	8″	45° Elbow.
5161	Two	30″	Pipe with brackets.
5162	Two	30″	Pipe.
5163	Two	30″	Discharge foot.
5165	One	8″ x 8″ x 12″	Tee R. H.
5166	One	8″ x 8″ x 12″	Tee L. H.

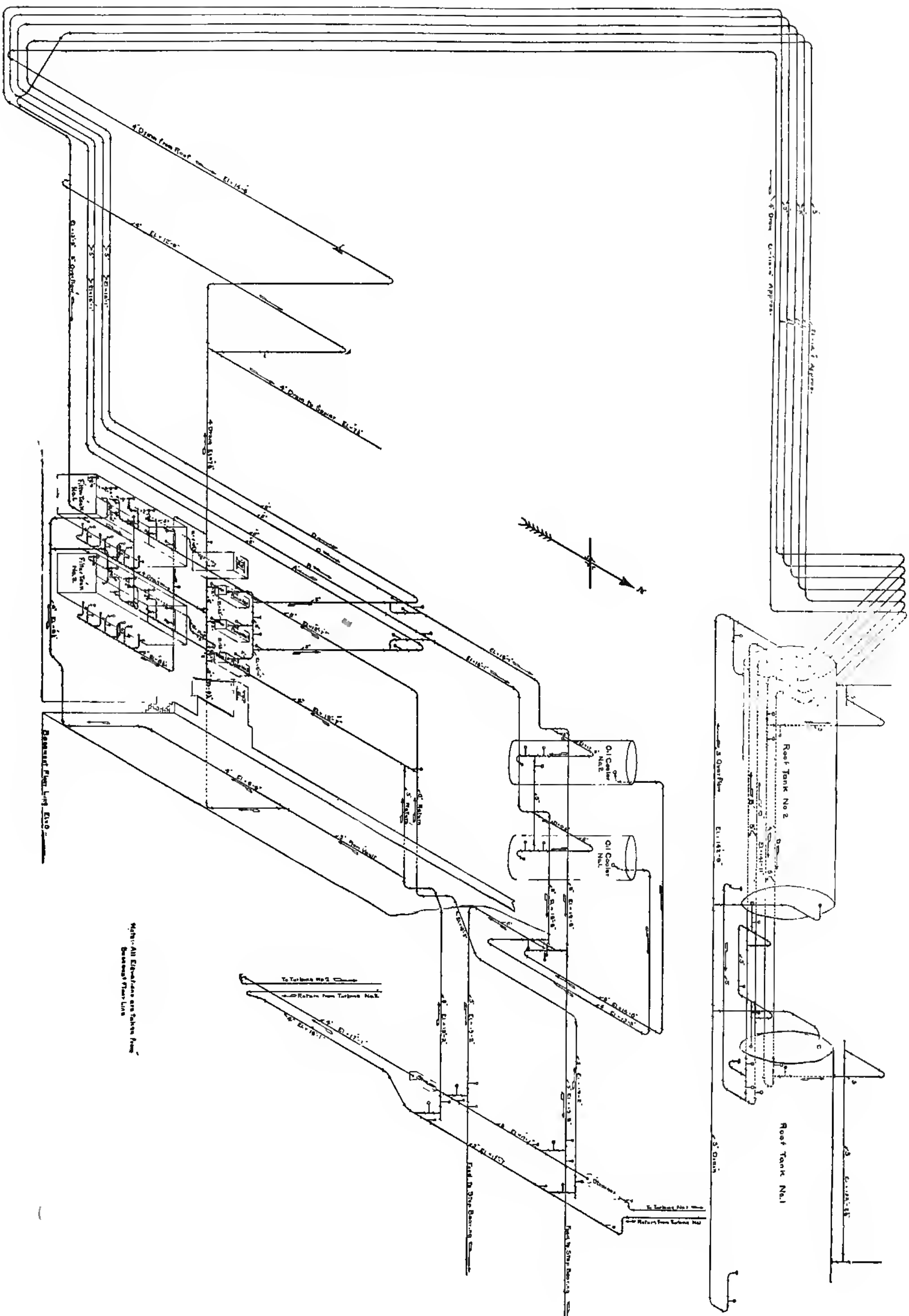
FINISH:

All the flanges of all the pipe and fittings and the joint faces of all the bosses for pipe connections are to have fine tool finish for gaskets; and the bottom surface of the supporting foot on the 36″ offset casting, pattern 5157 and the upper surface of the casting, pattern 5156 are to be finished to insure a proper bearing against each other.

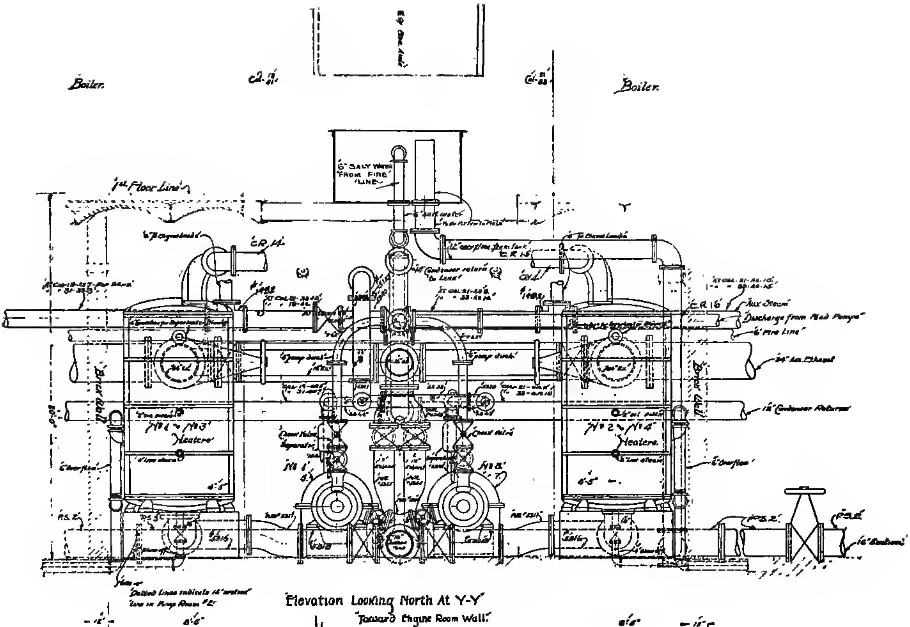
The 4½″ C. D. bosses on the side outlet castings, pattern 5154 are to have 3″ standard pipe thread.

The drilling of all flanges and the location of all studs are to conform to the details thereof as given on drawing No. 15677.

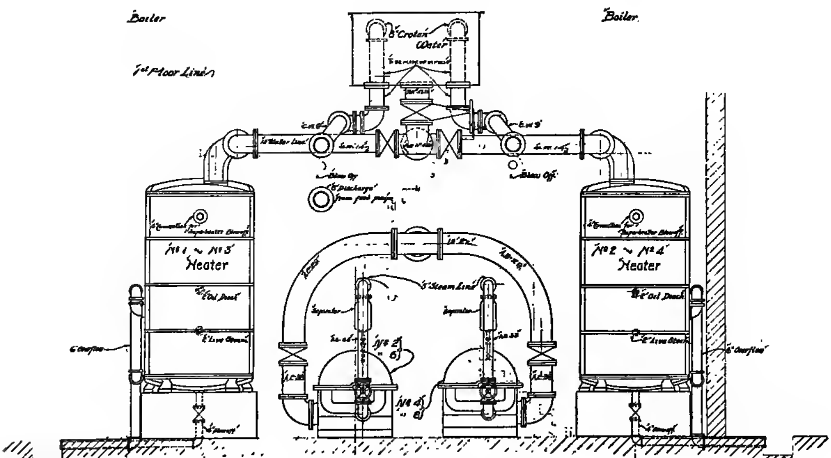
All patterns are to be made to conform to the drawings; they are to be marked before use in the foundry, by means of the usual metal pattern figures with their respective designating num-



ISOMETRIC OF OILING SYSTEM.

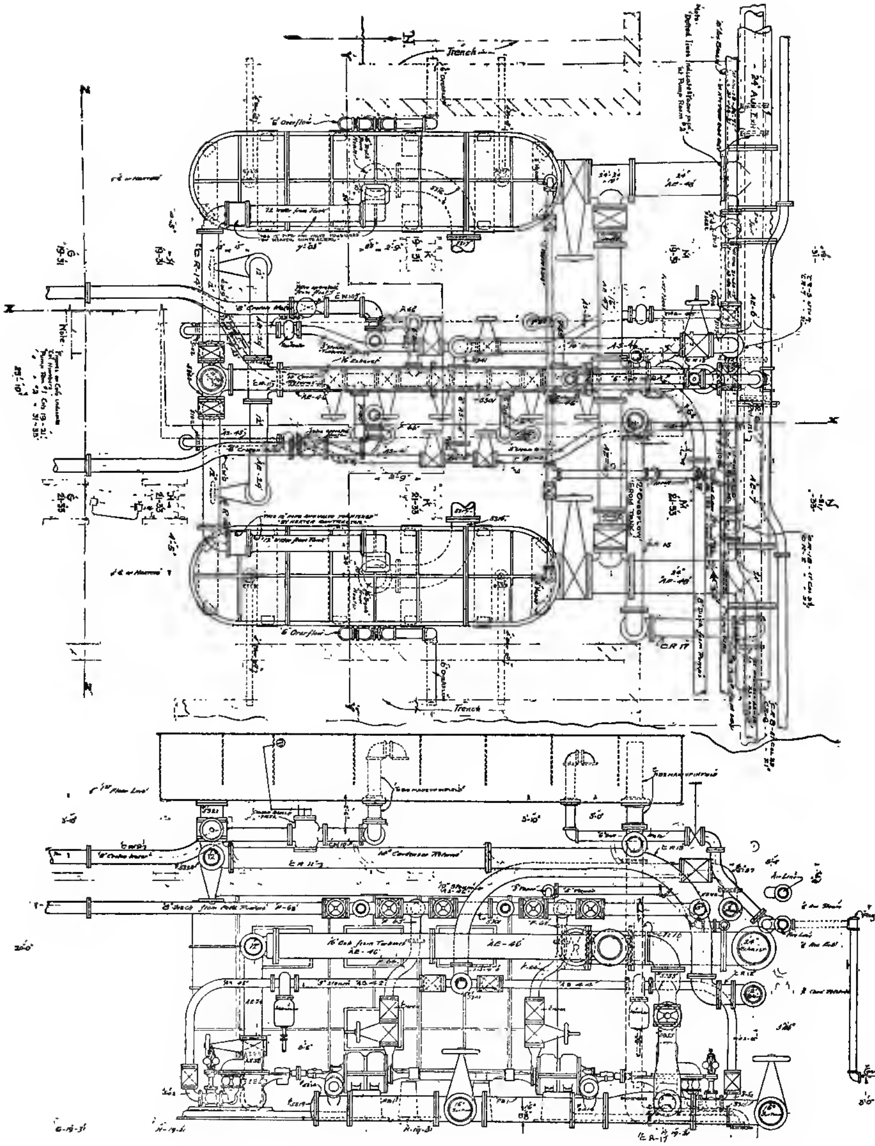


Elevation Looking North At Y-Y'
Toward Engine Room Wall.
No 1 & 2 Pump Rooms.



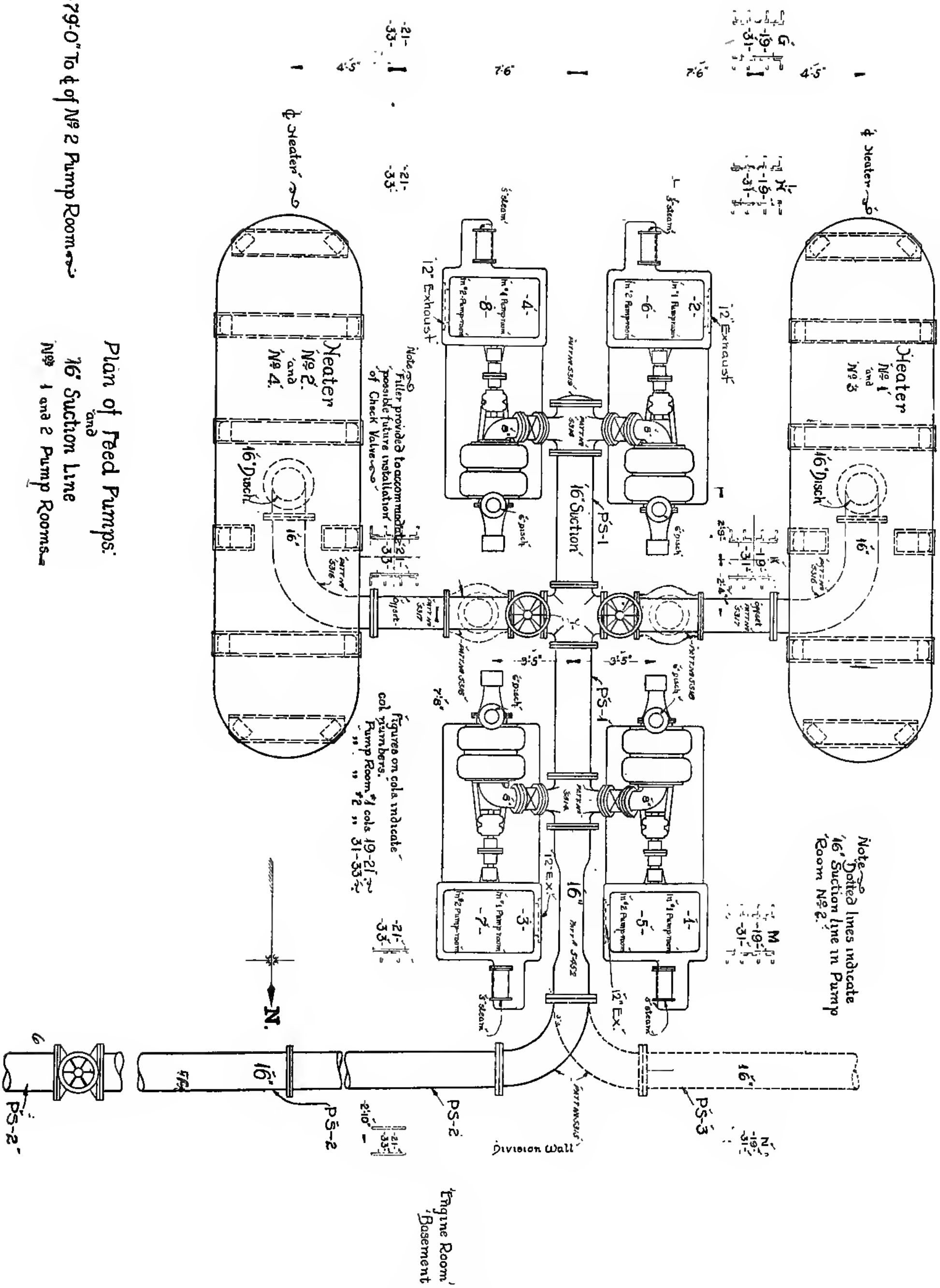
Elevation Looking North At Z-Z'
Toward Engine Room Wall.
No 1 & 2 Pump Rooms.

PLAN AND ELEVATION OF OPEN HEATERS AND PUMPS.



SECTION X-X

PLAN AND SECTION OF HEATERS, PUMPS AND CONNECTIONS.



PLAN OF FEED PUMPS.

bers as shown on drawing No. 15677; delivered to us with the castings therefrom and become our property.

All castings are to be true to the patterns and free from cold-shuts, blow-holes, cracks or any other defects; and their entire interior and exterior surfaces are to be free from all core sand, facing sand, chips, filings, etc. and unpainted when delivered.

ERECTION:

The Company will erect all of the material herein specified to be furnished and will supply all bolts and gaskets.

DELIVERY:

All of the material herein specified to be furnished by the Contractor is to be delivered where hereinbefore specified, or at such a point in the immediate vicinity as may be later directed on or before May 15, 1906.

EXHAUST PIPE EXPANSION JOINTS.

DESCRIPTION:

Expansion joints for exhaust piping. There are to be eight (8) expansion joints which are to be designed for the following sizes and requirements:

One	(1)	14″	for	1″	movement
Two	(2)	16″	for	¼″	"
Two	(2)	24″	for	¼″	"
Three	(3)	24″	for	⅜″	"

The diameters and drillings of the flanges of these joints are to conform to the Master Steam Fitters' Standard for these details.

The bodies of these joints must not exceed in any transverse dimension the diameter of their respective flanges and the Contractor is to give the face to face dimensions of each of the sizes of the expansion joints herein specified. The maximum working pressure to which these joints will be subjected in service will be

approximately five pounds per square inch above the atmosphere.

FINISH:

All material, workmanship and finish are to be satisfactory to the Engineer.

ERECTION:

The Company will do all erecting of the material herein specified to be furnished and will supply all bolts necessary therefor and all gaskets.

DELIVERY:

All the material herein specified to be furnished by the Contractor is to be delivered in good order and with flanges protected by wooden covers where hereinbefore specified or at such a point in the immediate vicinity as may be later directed on or before June 1, 1906.

CIRCULATING WATER VALVES.

NUMBER:

There are to be eleven (11) 30″ valves and seven (7) 36″ valves.

DESCRIPTION:

They are to be of the solid wedge, straight-way, gate type, for 50 pounds working pressure; brass mounted, with nonrising bronze stems, flanged ends and hand wheels, and for salt water use.

All castings are to be of uniform soundness and free from blow-holes, cold-shuts, cracks, or other defects, and absolutely cleaned of all foundry sand, scale, fillings, etc., before assembling.

The flanges are to be faced with fine tool finish for gaskets; parallel to each other and perpendicular to the axis of the valve;

their backs machined for proper seating of the heads and nuts of the bolts; and their diameter, thickness and drilling in conformity with the Master Steam Fitters' Standard.

All bolt holes are to be drilled to templates—not cored; bolts smaller in diameter than ¾″ must not be used in the construction of the valves; all parts are to be accurately and neatly fitted, and all material and workmanship are to be satisfactory to our Engineer.

Each valve is to be tested by, and at the expense of, the Contractor, in the presence of our representative, in the shop to 150 pounds.

All the valves are to be delivered where hereinbefore stated or at such point in the immediate vicinity as may be later directed, as soon as may be consistent with reasonably prompt despatch.

FIRE PROTECTION PIPING AND FIXTURES.

DESCRIPTION:

It is intended to have installed a system of piping and fixtures for fire service, with branches therefrom at indicated points for ash-wetting use, and for which branches the Contractor hereunder is to leave the necessary fittings and openings in the 6″ ring-header of the fire service system as shown. The ash-wetting piping is to be installed under another contract.

Certain ones of the drawings to which reference is made herein show other systems of piping than that which is the purpose of this specification, but the latter is indicated throughout by the lighter appearance on the blueprints due to shading on the tracings.

The Contractor hereunder will find installed the two "Underwriter" fire pumps which are indicated on drawing No. 16411, and from the discharge nozzles of which he is to extend the herein specified system of fire protection piping.

As shown on drawing No. 16411, the 5″ discharges of the pumps are to be run into an 8″ header leading to the 6″ ring-header and cross-connecting the pumps so that either pump may

discharge in either direction into the system. The 6″ ring-header, as the name indicates and as shown on drawings No. 16410 and 16411, is to form a continuous loop around the basement—at about 12′ 6″ from the floor—the former numbered drawing showing a continuation of the piping on the latter. Across the west end of the basement, it is shown broken away for clearness of reference to other work.

Outside of each pump connection to the 6″ ring-header, a 6″ "indicator" valve is to be placed having self-contained means for showing its closed and open positions. One valve of this type is also to be placed on each side of the 6″ branch to the roof and to the coal towers, near the southeast corner of the basement, two at other points in the ring-header, and one in each of the tower risers; in all, eight 6″ "indicator" valves.

From the 6″ ring-header, 4″ branches are to be run in the manner shown to points about 3′ 9″ from the basement floor, drops of approximately 9′ 0″; the three branches to the operating room side of the division wall having their change of direction from horizontal to vertical made with 4″ plugged tees, as shown on elevation drawings No. 16406 and 16407; and each of these drops is to be equipped at its lower end with a 2½″ heavy, angle, hose-end valve and a reel with 50′ of 2½″ hose.

From two points in the 6″ ring-header, along the north wall of the basement, 6″ branches are shown to be run to two feed water storage tanks for emergency use in connection therewith. These branches are shown, in plan, on drawings No. 16410 and No. 16411, and one of them, in elevation on drawing No. 16404. Only one of these branches is, however, to be installed under this specification. It is to be provided with a gate valve having an extended stem for its operation from the floor above. The flanges for the connection of the branch to the tank will be provided as part of the construction of the latter, but the Contractor hereunder is to connect the branch thereto both outside and inside of the tank, as is indicated on drawing 16406. The necessary blank-flanged 6″ tee for future extension of the other branch is to be left by this Contractor in the 6″ ring-header.

Near the southwest corner of the basement, a 5″ branch, with

a check valve, is to be run to a siamese connection which the Contractor is to install outside of the building on the sidewalk. The siamese connection and the manner of its installation are to conform to the rules and regulations of the Board of Fire Underwriters.

The various risers as indicated are to be run and in the manner shown; riser No. 5—that from which the connection for the coal towers is to be taken—is to be 6″ in size, the others being 4″. Two of these risers are to extend through the roof and be fitted with 2½″ hose valves, but not with reels or hose.

From the upper end of the 6″ riser, No. 5, a 6″ line is to be run toward the river bulkhead to a point between the two coal hoisting towers, extending thence and parallel to the bulkhead as 4″ lines to the towers, as shown on drawing No. 16437. Each tower is to be equipped with a 4″ riser to extend upward from its point of connection with the 4″ line for a distance of approximately 24 feet, and downward to a point about 3 feet above the grade line. The upper end of each one of the 4″ tower risers is to be fitted with a 4″ plugged tee, a 2½″ hose valve, and a reel with 25 feet of hose; and the lower end in each case is to be similarly fitted, except that the tee instead of being plugged is to be provided with a ¾″ nipple and valve for draining the riser if desired.

At ten, more or less, intermediate points on these risers, and three feet from the floor lines, tees are to be provided for the reception, each, of a 2½″ hose valve and reel; nine of these reels being supplied with 25 feet of hose each; and one with 50 feet of hose.

Each installation of hose throughout the system is to be provided with a suitable nozzle, or play pipe, 2½″ butt and 15″ long.

The system throughout is to be for salt water use.

MATERIAL:

All piping is to be full weight, of wrought steel and galvanized.

All fittings are to be malleable iron castings and galvanized.

All hose valves, couplings and nozzles are to be of brass; the nozzles to be of the "plain cast" pattern. Valves 2½" in size and smaller are to have brass bodies; larger than 2½" in size are to have iron bodies.

All hose is to be the best 2½" linen, "Underwriters," guaranteed for 400 lbs. pressure.

FINISH:

The system in general is to be screw work, but all fittings at the pump and ring-header connections, and all valves except the hose valves, and all pipe bends and offsets are to be flanged. The hose valves are to be screw connected.

All screw valves, couplings, nozzles and reels on the 4" riser to the mezzanines and which are shown on drawing No. 16422, are to be nickel plated and polished; the latter detail as to the reels, however, is to be determined later. The hose valves are to be finished, plated all over, and polished, and provided with finished, plated and polished brass wheels. All other valves are to be rough body, not plated, and with iron wheels; and all other reels are to be plain japanned.

All hose reels are to be solidly and substantially made and with swing brackets; their particular design and manufacture to be decided by this Company's Engineer.

The hose is to be in lengths of 50 feet, except as noted, and fitted with all necessary couplings.

All valves over the 2½" size, all flanges, flange unions, and all fittings—flange and screw—are to be extra heavy.

All pipe bends and offsets are to be free from wrinkling or buckling, and truly, carefully and neatly made.

All castings are to be sound and clean.

All threads are to be sharp, full and perfect; those on the hose ends of the hose valves, and on couplings and nozzles and hose connections throughout are to be New York Fire Department standard.

The 5" check valve is to be flanged extra heavy and of the swing type.

The diameter, thickness and drilling of all flanges are to conform to the extra heavy standard.

All material and workmanship are to be subject to the approval of this Company's Engineer.

TEST:

The entire system after erection is to be subjected to, and must satisfactorily stand, a hydrostatic pressure of 200 pounds per square inch.

ERECTION:

The Contractor hereunder is to furnish the labor for, and do, the erecting of all the material herein called for to be furnished by him; verifying all given and making all other required measurements, and supplying all pipe, fittings, valves, reels, hose and fixtures herein called for and needed for a complete installation in accord with the intent of this specification and the herein enumerated drawings.

This Company will provide all required openings and passages for piping, and will do any needed cutting or altering of building structure. It will further supply all hangers, riser clamps, or other necessary supports for the piping, but the Contractor hereunder is to locate and properly install them.

The use of couplings anywhere throughout the system will not be allowed. All connections of consecutive pipe lengths, where not made through fittings or valves, must be made by means of flange unions.

DELIVERY:

The Contractor hereunder is to prosecute work on the erection of the herein specified Fire Protection System in harmony with the progress of other work, and he is to complete the installation thereof, leaving a finished and satisfactory equipment ready for its intended use, on or before November 1, 1906.

GUARANTEE:

The Contractor hereunder is to guarantee this Company against all loss, damage or dissatisfaction due to defective material or workmanship for a period of one year from the date of the acceptance by this Company of the herein specified equipment.

SPECIFICATIONS FOR PIPE COVERING.

DESCRIPTION:

It is intended to cover certain piping, valves, fittings, flanges, flues and stacks, feed water heaters and boiler drums, in the herein specified manner, and for which the Contractor is to furnish the material and labor.

HIGH PRESSURE STEAM PIPING:

SIX INCHES (6″) AND OVER, IN DIAMETER:

All high pressure steam piping six inches, (6″), and over, in diameter is to be covered in the following manner. Next to the pipes there is to be placed a layer, one and one half inches (1½″) thick, of 85% carbonate of magnesia, wired on, and with all joints butted and grouted. On this a layer one quarter inch (¼″) thick of asbestos millboard is to be securely wired, with all joints butted, not lapped. Outside of, and against this layer of millboard is to be placed another layer, one and one half inches (1½″) thick, of 85% carbonate of magnesia, wired on, and with all joints butted; the end, or transverse joints to be midway between the similar joints of the first applied layer of magnesia. On this last course of magnesia is to be placed a layer one half inch (½″) thick of hard finish, applied in at least two (2) coats. Finally, over all there is to be tightly stretched, pasted, and sewed in place a covering of eight (8) ounce duck. In applying the duck, a sufficient quantity of paste

must be used to act as sizing, and thus prevent expansion and consequent wrinkling of the duck when it is subsequently painted.

All covering of fourteen inch (14″) piping is to be banded. Normally there will be placed a band at each side of, and comparatively close to, each removable flange cover; and the remaining bands which are to be placed along any length of covered pipe are to be located as near thirty-six inches (36″) apart, from centre to centre, as an equal division of the distance between the two bands placed near the flange covers will permit. The bands are to be of lacquered brass, and one and one half inches (1½″) wide.

The covering of all other high pressure steam piping six inches (6″) and over in diameter is not to be banded.

The flanges are to be fitted with removable covers. These covers are to be in halves and, when in place, are to be joined along a line diametral to the pipe flanges. Each half is to be, in itself, a separate and complete part. Each half is to be formed of an inner lining, one inch (1″) thick, of asbestos air-cell, over which, and securely fastened thereto, is to be placed a one half inch (½″) mesh frame of galvanized wire No. 22 B.W.G. This frame is to extend half way around the pair of flanges and be returned on the side of each flange.

The sides of the wire frame—formed by returning it on the sides of the pipe flanges—are to be reinforced by a layer of wire mesh cut to conform to the diameter and width of the returned portions of the frame. These reinforcing pieces of wire mesh and the turned over portions of the wire frames are to be strongly wired together. On the entire outside of this frame, there is to be applied a layer, one and one half inches (1½″) thick, of 85% carbonate of magnesia, in a powdered state and mixed with enough water to form a strong and solid mass. This layer of magnesia is then to receive a coating of hard finish over its entire outer surfaces, and on these surfaces, a layer, one quarter inch (¼″) thick, of asbestos millboard.

Finally the outer surfaces of the removable half cover are to be entirely covered with ten (10) ounce duck, tightly stretched,

returned around the edges of the half cover, pasted and sewed in place.

The halves of each cover are to be held together by two (2) galvanized steel bands, extending around each half cover under the canvas, each end of each band being passed through the canvas, two inches (2″) from the joint line of the halves of the cover, and the ends of the opposite bands joined by reeving them through flat eyes and bending them back on themselves. These bands are to be placed about one inch (1″) from each side of the cover.

All steam separators, necks and bodies of all valves, all fittings and all irregular surfaces are to be covered in the manner herein specified for piping. The bonnets and bonnet flanges of all valves are to be covered as herein later specified.

All valves are to be fitted with removable covers which shall completely enclose their bonnets, and bonnet flanges. In the manner of their construction these removable covers are to be in general like those herein specified to be provided for the pipe flanges; but details of their design must be submitted, for approval, to this company's Engineer, before their final application to the valves.

All covering of steam separators is to be banded. The bands are to be of lacquered brass, three inches (3″) wide, and spaced as may be directed by this Company's Engineer.

UNDER SIX INCHES (6″) IN DIAMETER:

All high pressure steam piping under six inches (6″) in diameter is to be covered with 85% carbonate of magnesia sectional covering, made up in duck-jacketed lengths of about thirty-six inches (36″) and two inches (2″) thick. Each length is to be in half sections united by the jacket of duck, and is to be applied to the piping by opening it along one side—on the duck as a hinge—and closing it around the piping; after which the lap of the jacket is to be tightly stretched and securely pasted on the opposite section.

The transverse joints between the ends of consecutive lengths of the covering are to have securely pasted over them

a strip four inches (4″) wide, of eight (8) ounce duck in addition to any end lap of the jacket with which the lengths of covering may come provided.

All covering is to be properly secured by black enameled bands; in general three (3) bands per normal length of covering.

All valves, fittings, and flanges, are to be covered with a plaster two inches (2″) thick, of 85% carbonate of magnesia, after which there is to be applied to the entire outer surfaces of the magnesia a layer one-half inch (½″) thick, of hard finish, and finally over all a jacket of eight (8) ounce duck is to be tightly stretched, securely pasted and sewed in place.

HIGH PRESSURE DRIP PIPING.

All high pressure drip piping and all of the valves, fittings and flanges thereof, are to be covered and banded in a manner similar to that herein specified under sub-heading "Under Six Inches (6″) in Diameter."

WATER PIPING.

Boiler Feed:

All boiler feed piping is to be covered and banded in a manner similar to that herein specified under sub-heading "Under Six Inches (6″) in Diameter," except that it is to be one inch (1″) instead of two inches (2″) thick.

All valves, fittings and flanges are to remain uncovered.

Subject to Freezing:

All piping subject to freezing is to be covered with a layer two inches (2″) thick, of hair felt, amply and securely bound with marline, over which a jacket of ten (10) ounce duck is to be tightly stretched and sewed in place.

All valves, fittings, flanges and the pipe-encircling portions of all hangers, are to be covered in a similar manner.

LOW PRESSURE STEAM PIPING.

Exhaust and all other Low Pressure Steam Piping:

All piping which is to be used for Exhaust Service and all other low pressure piping for which the covering has not so far herein been specified, are to be covered in a manner similar to that herein specified under the sub-heading "Boiler Feed."

FLUES AND STACKS.

All flues and stacks, from the boiler up to the underside of the coal bunkers, are to be covered in the following manner: Outside of and against the framing or stiffening members of the structure lengths of one half inch (½″) standard pipe are to be laid at suitable distances from each other and held in place by one quarter inch (¼″) wire rope to be passed continuously around the flue or stack, drawn tight and secured against slipping. At each intersection of the wire rope and the pieces of pipe, they are to be firmly wired to each other.

To this skeleton of pipe and rope, there is to be fastened throughout a metal lathing of the Bostwick or other approved style. The lathing is then to receive a layer, one and one half inches (1½″) thick, of asbestos in cement or block form. If cement be used its final surface is to be left approximately smooth. Outside of and immediately against the entire outer surface of the completed layer of asbestos chicken netting is to be placed and secured to the metal lathing by clips, hooks or other appropriate and satisfactory means which shall have been fastened to the lathing before the layer of asbestos was applied.

On the chicken netting there is then to be spread, of hard finish, a coat sufficiently thick to cover, to an even plane, all inequalities of surface of the asbestos and netting, and troweled smooth. Finally the outer surfaces of the hard finish are to be jacketed with eight (8) ounce duck, tightly stretched, and securely pasted on the hard finished surfaces, and in addition

fastened to the lathing by some approved device previously left attached thereto for that purpose.

The continuity of this covering is to be interrupted at certain places to be directed by this Company's Engineer, by narrow spaces to be left through the entire thickness of the covering, including the lathing. These spaces are then to be covered by strips, eight inches (8") wide each, of eight (8) ounce duck properly pasted in place centrally over the spaces.

The one-half inch (½") pipe herein specified as a detail in the application of this covering may be second-hand material, but the lengths must be straight and long enough to extend, with ample lap at each end, between consecutive members of the flue and stack framing or stiffening.

Before any covering is applied, the proposed details of its material and methods of application must be submitted to this Company's Engineer for his approval.

FEED WATER HEATERS.

All feed-water heaters are to be covered in a manner similar, or approximately similar to that herein specified under subheading "flues and stacks," so far as the insulating material is concerned.

BOILER DRUMS.

The ends of all boiler drums are to be covered in the following manner: Against both ends of each drum are to be laid blocks, one and one-half inches (1½") thick, of 85% carbonate of magnesia. These are to be held in place by wire netting fastened by some approved method. The magnesia blocks are then to be completely covered by a coat, one half inch (½") thick of hard finish, troweled smooth, and this latter finally by a jacket of eight (8) ounce duck securely sewed and if necessary otherwise fastened in place.

Before any covering is applied, the same requirement as to approval is to be observed as herein specified under "flues and stacks."

There are to be two hundred and eighty-eight (288) of these drums, forty-two inches (42″) in diameter.

FINISH:

HIGH PRESSURE STEAM PIPING.

SIX INCHES (6″) AND OVER IN DIAMETER:

All joints are to be closely, evenly, and neatly made throughout their lengths; those in the initial layer of carbonate of magnesia grouted up with hard finish and made smooth. The initial layer of magnesia, the layer of millboard, and the second layer of magnesia are to be wired on independently of each other; and special care must be taken in this detail to insure an entirely secure wiring of the segments, or parts, of the different layers in place.

All hard finish is to be well worked into the magnesia as far as practicable, and troweled smooth.

All pasting of duck jackets is to be made with even and neat edges; and all sewing is to be done in a similarly neat manner.

All covering and jackets are to fit snugly against, and over the pipe-encircling parts of all hangers, so that there will not, in any case, be any of such parts of the hangers visible, except where such parts may be outside of the general plane of the exterior of the pipe covering.

Where the edges of the duck jackets come within one inch (1″) of any metal surface, they are to be protected by some material which will not char, break, powder or otherwise disintegrate.

At all flanges, the covering is to be chamfered throughout its circumference, at an angle of forty-five degrees (45°)

to the axis of the pipe, until it is of such lesser thickness that the flange bolts can be removed from the flanges without disturbing the integrity of the covering. The length of any such diametrally reduced portion of the covering is not to be more than enough for the hereinbefore stated purpose, and, for uniformity of appearance, the reduction of the diameter of the covering is to be equal distances on each side of any pair of flanges; except at valves and fittings, where, as the heads of the bolts will be on the pipe-side of the flange-joint, a greater length of reduction will be on that side. Where two or more valves or fittings are to be bolted together, the details of provision for bolt removal must harmonize with local requirements.

In applying the covering to all valves, fittings and irregular surfaces, special care must be taken to insure an entirely secure wiring of the segments or parts thereof, of the covering material in place.

Neatness of manner in placing the bands will be insisted upon, to the end that all of these on the curved portions of the piping will be radial thereto, and on the straight portion of the piping, at right angles to its axis; and their ends properly locked.

All corners of the flange covers are to be square and neatly made; and the joints between the halves of the covers and between the completed covers and the pipe covering, are to be tight and close fitting.

UNDER SIX INCHES (6″) IN DIAMETER AND HIGH PRESSURE DRIP PIPING:

All joints are to be closely, evenly, and neatly made throughout their lengths.

All details of covering of hangers, hard finish, pasting, provision for the removal of bolts, sewing and banding, are to be observed as specified under "Six Inches (6″) and Over in Diameter."

WATER PIPING.

Boiler Feed:

As the valves, fittings, and flanges are to remain uncovered, except where specially directed to be otherwise by this Company's Engineer, the ends of the sections of the pipe covering are to be laid close to the flanges throughout, without gaps or appreciable spaces between the covering and the flanges.

All requirements of neatness of application of the covering and the bands and all details of covering of hangers, pasting, and provision for the removal of bolts, are to be observed as specified under "Six Inches (6″) and Over in Diameter."

Subject to Freezing:

All details of covering of hangers and of sewing and so far as permissible by the kind of covering herein specified under this heading—provision for the removal of flange bolts, and general neatness of application of the covering, are to be observed as under "Six Inches (6″) and Over in Diameter."

General:

Wherever butt joints are called for in this specification it shall be understood to mean that the edges of abutting segments, sections, or parts of the covering material are to be square cornered; and all of such joints are to be closely, evenly and neatly made. Lap joints will not be permitted.

All bends are to be covered in the same general manner as has herein been specified for the straight portions of the particular line, or lines, of piping in which such bends will be included; except for the added detail necessary to insure the completed covering conforming as far as is consistent with practical and workmanlike methods, to the curves to which it is to be applied.

All bands which are to be placed on vertical or approximately vertical surfaces are to be secured, by some approved mode, against slipping from their intended locations.

All workmanship, design and material as to quantity and

quality, are to be subject to the approval of this Company's Engineer.

Erection:

The Contractor is to do all of the erecting or placing of all of the material for the different designs of covering as herein specified, and as per the accompanying typewritten list, which approximately shows the linear feet and normal sizes of all piping referred to under the various headings and subheadings of this specification, together with all valves, fittings and flanges thereof. This Company will do all of the painting.

Conduct of Workmen:

In view of the large amount of dirt which can be occasioned by the herein specified kind of work, the conduct of all workmen engaged in performing it is to be under the supervision of this Company's Superintendent of Construction or his representative; and his directions are to be followed in all matters relating to the methods and appliances used by them.

Delivery:

All of the material herein specified to be furnished by the Contractor, is to be delivered where, and as, herein specified, or at such point in the immediate vicinity as may be later directed and as per the following schedule.

Between date of contract and April 2nd, 1906: approximately one fourth (¼) of the total quantity of the material called for by this specification.

On demand between April 2nd 1906 and December 1, 1906: approximately three fourths (¾) of the total quantity of the material called for by this specification.

The following is a list of approximate number of linear and square feet of non-conducting covering to be applied to piping, flues and stacks, feed-water heaters, boiler drums, etc., and of valves and fittings to be covered, in Waterside Station No. 2. For the high pressure steam, and exhaust and other low pressure

steam systems, the number of flanges to be covered can be approximated from the number of lengths of piping as given herein. For the high pressure drip system the number of flanges to be covered is approximately as herein given.

Boiler feed piping six inches (6″) in diameter, and high pressure steam piping six inches (6″) and over in diameter, are to have Van Stone flanged joints.

The piping is to be covered to, but exclusive of, the engine throttles.

This list is to accompany the Specification for non-conducting covering material for Waterside Station No. 2; R. N. 2001.

PIPE.

Flanged Joints.

High Pressure Steam:

Nominal Sizes.	Average Lengths.	Linear Feet Straight.	Linear Feet Bent.
1½″	6′ 0″	300	
2″	6′ 0″	100	
2½″	6′ 0″	300	
3″	6′ 0″	200	
3½″	6′ 0″	200	
4″	6′ 0″	250	
5″	6′ 0″	140	60
6″	10′ 0″	300	100
8″	10′ 0″	300	40
8″	20′ 0″		2000
10″	10′ 0″	160	
12″	12′ 0″	320	80
14″ (15″ OD)	10′ 0″	1600	400

High Pressure Drip:

Nominal Sizes.	Average Lengths.	Linear Feet Straight.	Bent.
¾″		225	
1″		50	
1¼″		2050	
2″		3600	
3″		670	
5″		440	

Boiler Feed:

Nominal Sizes.	Average Lengths.	Linear Feet Straight.	Bent.
2½″	10′ 0″		2880
3″	6′ 0″	3180	2120
5″	5′ 0″	100	
6″	12′ 0″	3150	350
8″	2′ 6″	40	
16″	10′ 0″	100	

Subject to Freezing (Cast iron flanged:)

Nominal Sizes.	Average Lengths.	Linear Feet Straight.	Bent.
4″		100	
12″		600	

Exhaust and Other Low Pressure Steam:

Nominal Sizes.	Average Lengths.	Linear Feet Straight.	Bent.
3½″	6′ 0″	200	
4″	6′ 0″	200	
5″	6′ 0″	100	
6″	6′ 0″	100	
10″	10′ 0″	100	
12″	10′ 0″	50	
14″	10′ 0″	250	

VALVES AND FITTINGS.

Flanged; Extra Heavy.

HIGH PRESSURE STEAM:

	FITTINGS.					
Sizes.	Valves.	Ells.	Tees.	Crosses.	Miscellaneous.	
1¼″	10	20				
1½″	10	40				
2″		20				
2½″	10				Flanges	30
2½″					Blanks Flgs.	96
3″		10			Flanges	50
3″ x 3″ x 1½″ x 1¼″				10		

VALVES AND FITTINGS (Continued).

	FITTINGS.					
Sizes.	Valves.	Ells.	Tees.	Crosses.	Miscellaneous.	
3½″					Flanges	40
4″					Flanges	40
4″ x 4″ x 2″ x 1½″				10		
4½″	10	5			Flanges	30
5″					Flanges	20
5″					Blank flgs.	5
5″ x 5″ x 4½″			5			
6″	5		5		Flanges	60
6″					Blank flgs.	5
6″ x 6″ x 3″			5			
6″ x 4″ x 4″			5			
8″	192				Flanges	25
8″ x 6″ x 6″			5			
8″ x 6″ x 3″ x 4½″				5		
10″	6	5			Flanges	5
10″ x 8″ x 6″			10			

10″ x 10″ x 6″				8		
10″ x 12″ x 8″				8		
12″		24				
12″ x 12″ x 8″				36		
12″ x 12″ x 14″				2		
12″ x 14″ x 8″				12		
14″		66	6	40	Blank flgs.	6
14″					Filler ring-5½″ wide	1
14″					Filler ring-8¼″ wide	1
14″	45		16			
14″ x 14″ x 6″				10		
14″ x 14″ x 8″				8		

Boiler Cross-Over Fittings, as per drawing 13653 and the following pattern numbers:

5020	48
5021	48
5022	48
5023	48
5032	96

High Pressure Drip:

FITTINGS.

Sizes.	Valves.	Ells.	Tees.	Y's.	Flg. Unions.	Flanges.
¾″	12				8	14
1″					3	
1¼″	72	276			30	550
1¼″ x 1¼″ x 2″			6			
2″	11				15	280

2" x 2" x ¾"		15			
2" x 2" x 1¼"		164	27		
2" x 2" x 2"			1		
3"	6			3	170
3" x 3" x 2"		8			
3" x 3" x 3"		4			
5"	9				60
5" x 5" x 3"		13			

SUBJECT TO FREEZING:

Sizes.	Valves.	Ells.
4"	8	16
6"	8	12
12"	2	4

EXHAUST AND OTHER LOW PRESSURE STEAM:

Sizes.	Valves.	Ells.
1½"	10	20
3½"	10	20
4"		10
5"		10
6"		10
10"		10
12"		10
14"		4

FLUES AND STACKS:

32,000 square feet.

FEED-WATER HEATERS:

2,500 square feet.

BOILER DRUMS:

5,500 square feet.

SPECIFICATIONS

Accompanied by drawings for the

STORAGE BATTERY PLANT

of the New Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, Being part of the Contract dated March 5, 1906, between The Electric Storage Battery Company, Contractors, and The New York Edison Company.

GENERAL.

The Contractor shall furnish and install in a building or space suitably prepared for the purpose by the Company, at the new Waterside power station a storage battery plant with accessories, in accordance with the terms and conditions of the following specification:

ELEMENTS:

One hundred and fifty (150) elements of the Contractor's latest improved type, to be installed seventy-five (75) cells in series on each side of the three-wire system. Each element shall contain not less than thirty-nine (39) plates known as type "R" whose dimensions shall be approximately 18⅝ x

18⅝ inches. Each plate shall be provided with a lug of sufficient area to carry the current from it without undue heating, and to make a rigid connection when burned to the lead bus bar.

CAPACITY:

The capacity of the battery at approximately 70° F. shall be not less than two thousand (2,000) amperes for one (1) hour on each side of the system, with a minimum total pressure at the end of discharge at this rate of one hundred and twenty (120) volts. The capacities at various rates at the same temperature shall be not less than the following:

Rate of Discharge.	Capacity.
2,000 Amperes.	2,000 Ampere Hours
885 "	2,655 " "
Normal Rate of Charge.	Maximum Rate of Charge.
570 Amperes.	800 Amperes

During discharge at rates not exceeding the three-hour rate, the voltage shall not fall below an average of 1.7 volts per cell; at the end of discharge at the one-hour rate it may drop to an average of 1.6 volts; readings to be taken at the cell bus bars.

LEAD-LINED TANKS:

One hundred and fifty (150) lead-lined wooden tanks suitable in size for elements of not less than 39 plates. These tanks shall be made of thoroughly seasoned lumber, with dovetailed joints, without the use of nails or other metallic fastenings, bottoms suitably drained and ventilated, and shall be lined with sheet lead with overlapping seams, the lead to extend over the upper edges of the tanks. The tanks shall be treated with two coats of acid-resisting composition and suitably numbered.

Separators and Supports for Plates:

The plates shall be separated by suitable separators, and shall be supported by sheets of glass resting upon lead strips on the bottoms of the tanks.

Electrolyte:

Electrolyte of the proper density and purity to effect the best results shall be furnished in quantity sufficient to fill the cells.

Insulation and Supporting Structure:

The cells shall be supported on a double tier of insulators, resting on tiles or vitrified bricks laid in sulphur, the two tiers being separated by suitable wooden rests, treated with two coats of acid-resisting composition.

Assembling and Lead Burning:

The cells shall be connected together in two series, the plates in each cell being burned to rolled lead bus bars. Cells to be located on floors, one tier on each floor.

Re-enforced Bus Bars:

The terminal cells of each row and the end cells, on each side of the system, shall have their lead bus bars re-enforced with copper bar encased in the lead, with suitable terminals for connecting to the copper bar running between rows and from the cells to the cell switches.

Regulating or End Cell Switches:

The Contractor shall furnish and erect four (4) twenty-point regulating switches, two (2) on each side of the sys-

tem capable of carrying two thousand (2,000) amperes each without undue heating or sparking; these switches to be located on the outside of the partition wall of the battery room. The necessary supporting ironwork for these switches, also the partitions for separating them from the battery room, will be provided by the Company in accordance with drawings furnished by the Contractor. There shall be mounted on each cell switch a motor for driving the traveling brush, with worm gear and clutch; the Contractor's automatic control switch for stopping the brush only when in full contact with a switch point; and automatic circuit openers for stopping the motor when the brush reaches either extreme of its travel. With each cell switch shall also be furnished the Contractor's motor control switch for operating the cell switch from a distance, and the Contractor's electrical indicator, for indicating at the switchboard the location and travel of the cell switch brush. All indicating and controlling apparatus shall be mounted on the switchboard by the Company. These switches shall also be provided with hand wheels mounted directly upon the switches to enable them to be operated by hand if desired.

Lead-coated Copper Conductors:

The Contractor shall supply and install lead-coated hard drawn copper bar of not less than 97½ per cent. conductivity for connecting the end cells with the end cell switches; the copper bar for each end cell shall have a cross-sectional area of one and one-half (1½) square inches, and shall be bolted to the riser of the corresponding re-enforced bus bar and accurately fitted to the terminals of the regulating switches. The Contractor shall also supply and install two (2) conductors from the neutral point of the battery, each having a sectional area of one and one-half (1½) square inches, running to a point just outside of the battery room adjacent to the cell switches, and there connect to two single pole knife switches furnished and installed by the Company to which the Company will connect the neutral of his system. All conductors which carry current continuously during the discharge of the

battery shall have a cross-sectional area of $1\frac{1}{2}$ square inches. All cutting away and making good of walls, ceilings, etc., will be done by the Company. All channel irons, I beams and other supports, such as hangers, brackets, etc., for supporting and holding in position these copper conductors, will be furnished and installed by the Company in accordance with drawings furnished by the Contractor. All insulators for these copper conductors shall be furnished and installed by the Contractor.

CONNECTIONS AND CABLE WORK:

All connections and conductors other than those between the end cells and the end cell switches will be provided and installed by the Company, viz.: connections between cell switches and switchboard; all conductors between switchboard panel and Company's bus bars, both for charging and discharging; and connections from the battery neutral to the neutral of the Company's system. The following wiring will be furnished and run by the Company, but connected by the Contractor, viz.: wiring between end cell switch motors and motor control switches on switchboard panel; all voltmeter connections for high reading, low reading and recording voltmeters and connections between end cell switches and electrical indicators.

TESTING INSTRUMENTS:

There shall be furnished one low reading portable voltmeter of the Contractor's standard design, with contact board, for reading individual cells; six standard hydrometers for testing the specific gravity of the electrolyte; one standard cell inspection lamp, with socket, flexible leads and contact clips; one automatic pilot cell filler; and one compensating hydrometer.

DRAWINGS:

The Company will furnish dimensioned drawings of the space available for the battery installation, showing plan, elevation, all obstructions, offsets in walls, doors, windows, and ceiling construction with locations and dimensions of beams which can be used for supporting copper.

BATTERY ROOM:

The battery room will be suitably prepared for the reception of the battery by the Company, who will also furnish any ventilating, heating and drainage systems that may be necessary, and a sufficient supply of pure water or dilute acid for filling all the cells from time to time, after the first charge. The normal temperature of the battery room is to be approximately 70° F.

ERECTION:

The Contractor shall furnish the services of a superintending engineer and competent men to install the plant. During and after erection, the Company will co-operate to the fullest extent with the Contractor especially in keeping the battery room free from any operations which may prove injurious to the battery.

FIRST CHARGE:

The Company will furnish the necessary current at proper voltage for the first charging of the battery.

OPERATION:

The Contractor shall furnish for a period of three days after the first charge a competent man to fully instruct a designated employee of the Company in the proper care and manipulation of the battery.

TEST:

Within one week after its first charge, the battery shall be tested by the Company or its representative, during which test representatives of the Contractor may be present, to determine its ability to meet the capacities called for herein.

FREIGHT, CARTAGE AND UNSKILLED LABOR:

All charges for freight shall be paid by the Contractor. All cartage shall be furnished by the Contractor. All unskilled labor shall be furnished by the Contractor.

DELIVERY:

To be agreed upon; the batteries to be taken during 1906.

COPPER:

It is understood and agreed that the arrangement of the cells and regulating switches of these batteries shall be substantially the same as in the 83d Street battery station of the Company. Should this arrangement be so modified as to increase the length of run of the conductors for the cells or the series connections any appreciable increase in the amount of copper or labor shall be supplied by the Contractor at a proportionate increase of price.

It is also understood and agreed that one of the four batteries shall be erected with only one hundred and forty cells, fifteen on each side being end cells, and that a proper allowance shall be made the Company by the Contractor for the cells omitted.

SPECIFICATIONS

Accompanied by drawings for the

Electrical Apparatus for Control of 25 Cycle Generators and Feeders.

of the New Waterside Power Station.

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. Being a part of a Contract between the General Electric Company, Contractors, and The New York Edison Company.

ITEM NO. 1: GENERATOR CONTROL.

10-generator control pedestals and instrument panels for the control of eight 8,000-k. w., 6,600-volt, 25-cycle generators and two 7,500-k. w., 6,600-volt, 25-cycle generators.

Panels to be of blue Vermont marble.

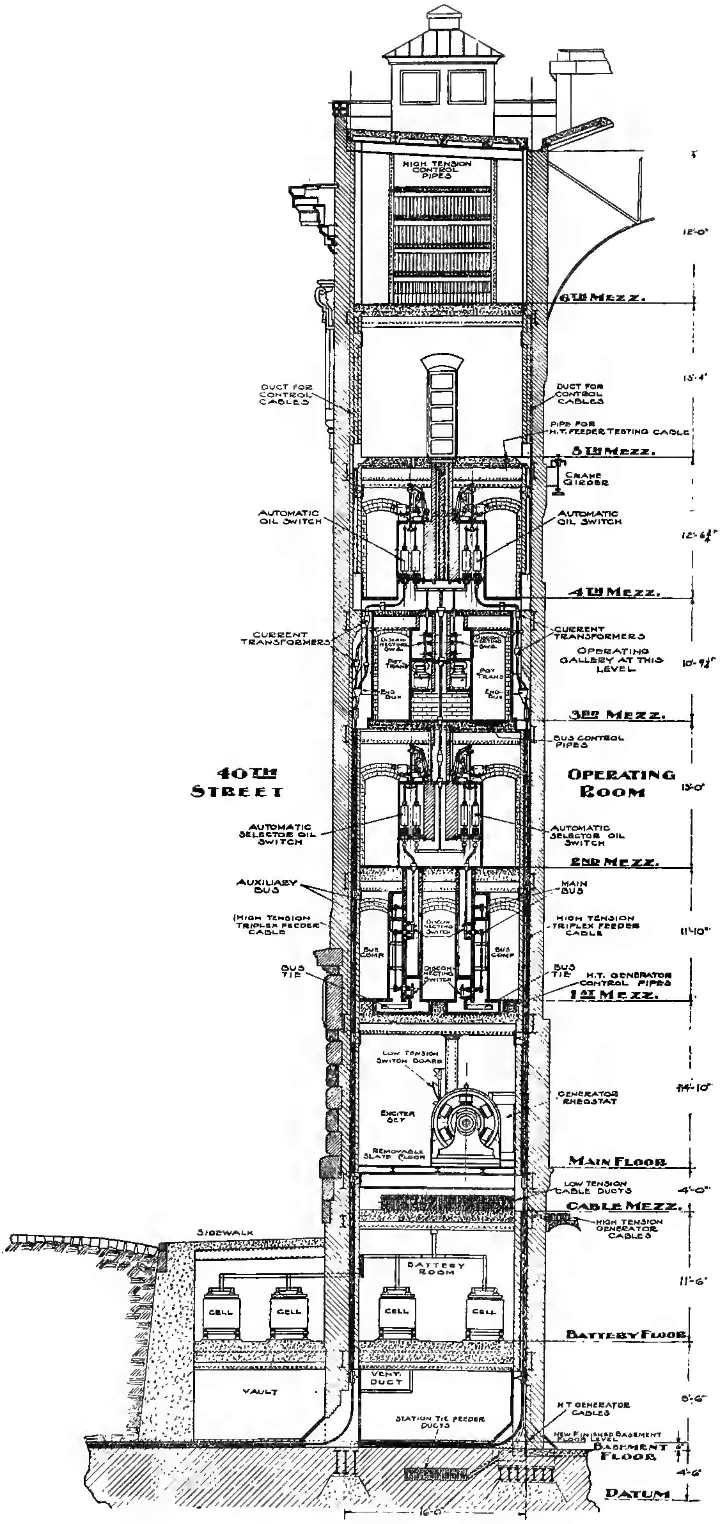
Instruments to have marine finish.

Panels to be supplied with necessary card holders and name plates as shown on accompanying drawing.

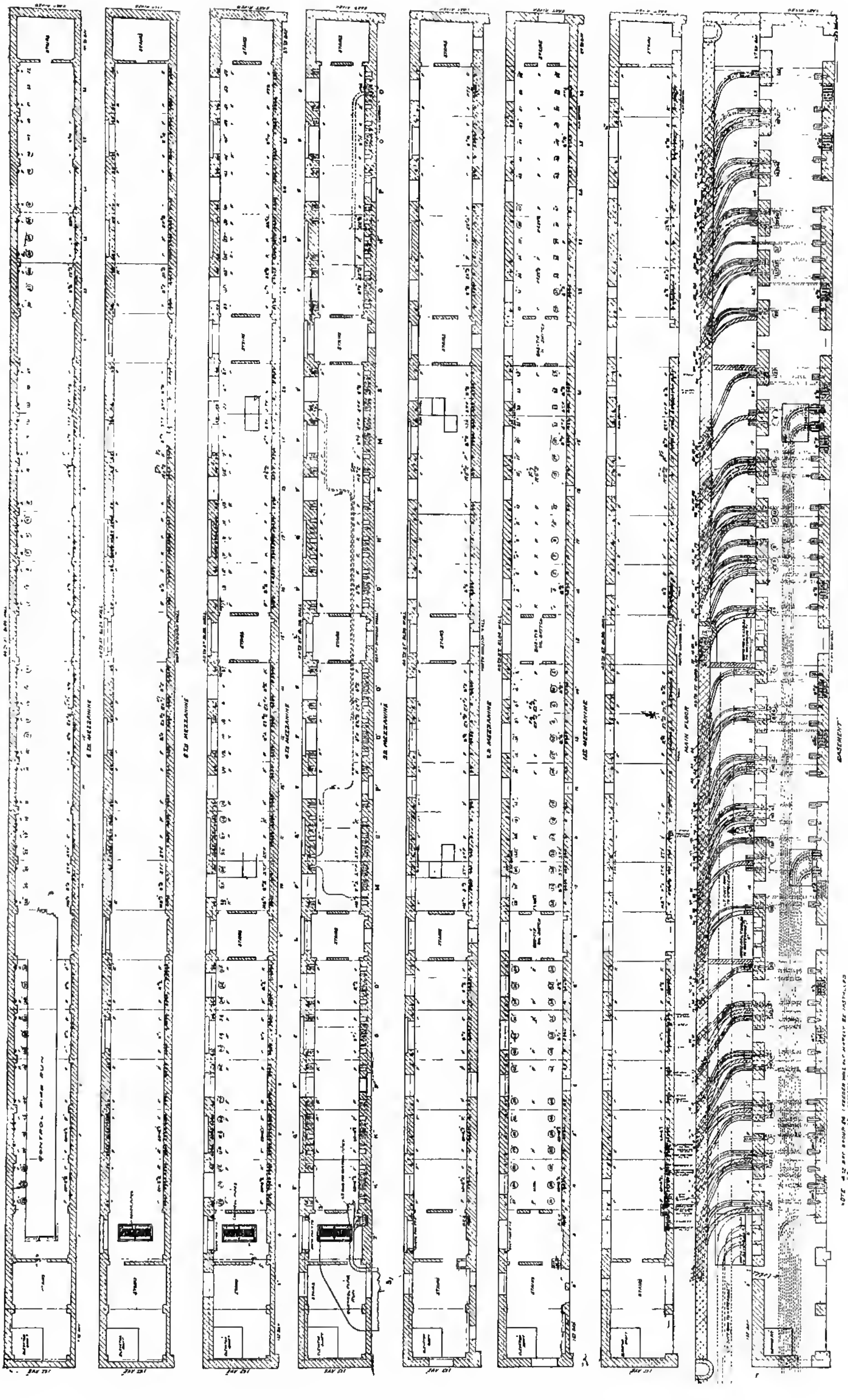
The equipment for each control pedestal and instrument panel will comprise the following:

1 Instrument panel 38″ x 20″ x 2″.

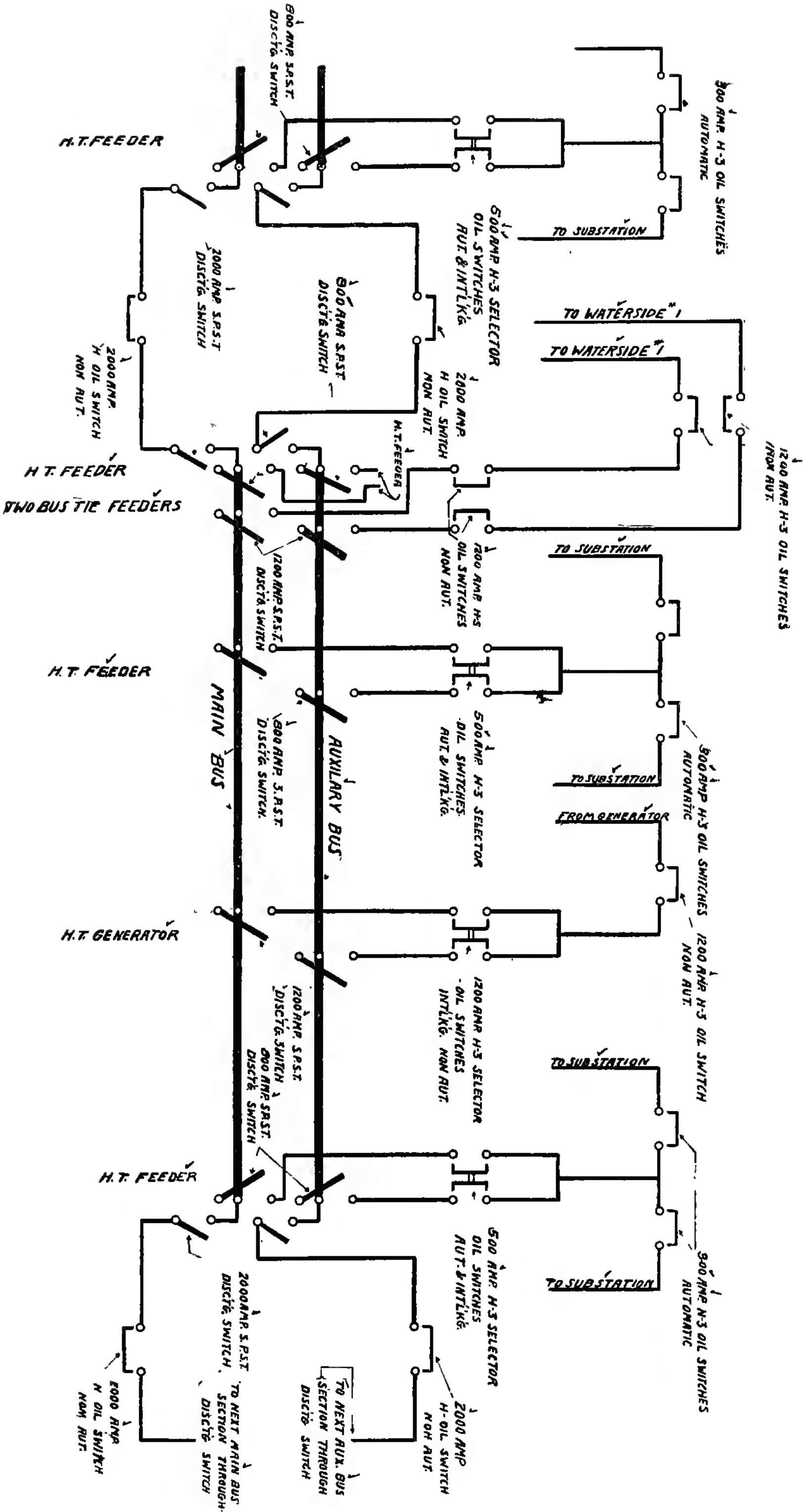
1 Front of pedestal 32¼″ x 18⅜″ x 2″.



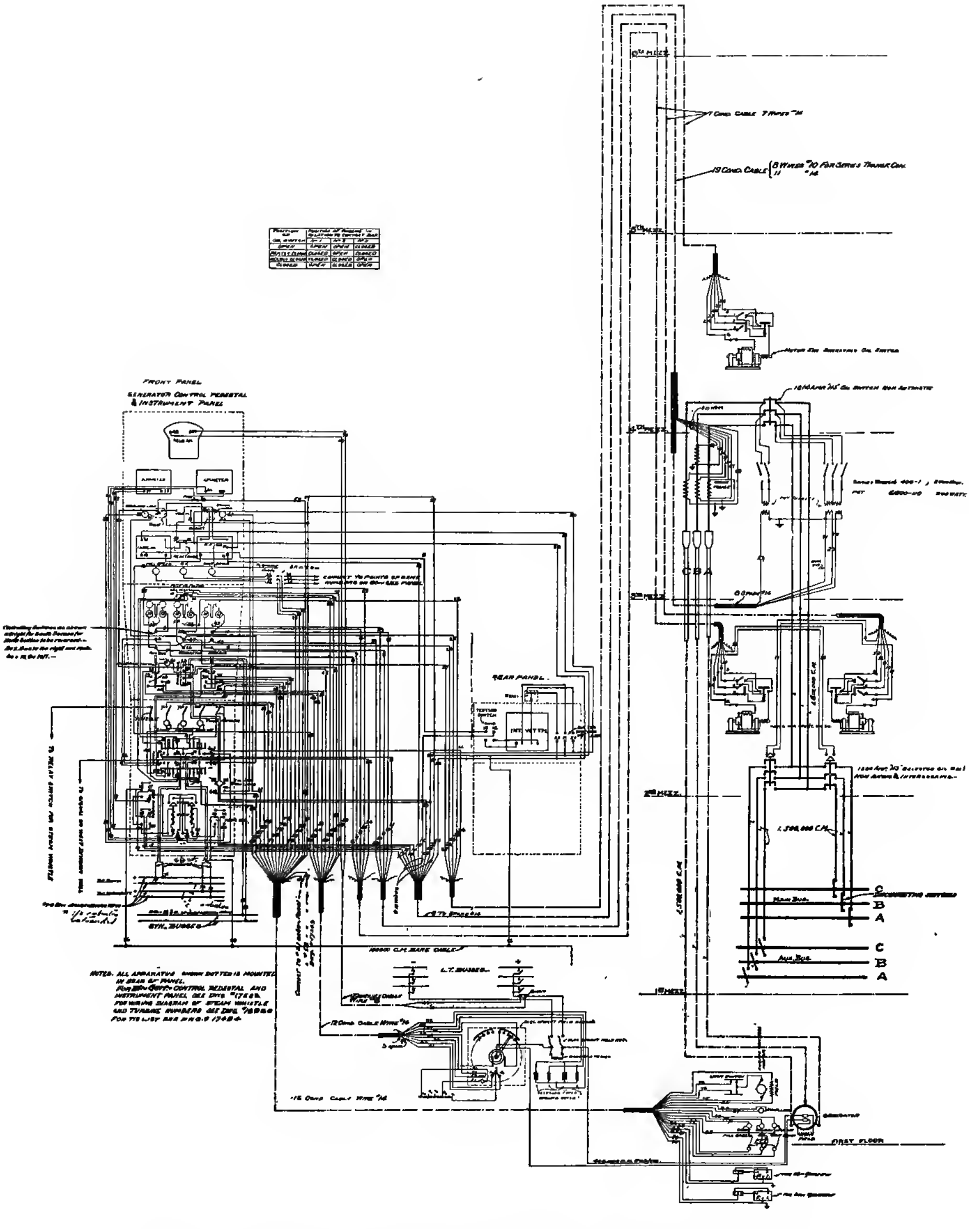
CROSS SECTION THROUGH ELECTRICAL GALLERIES.



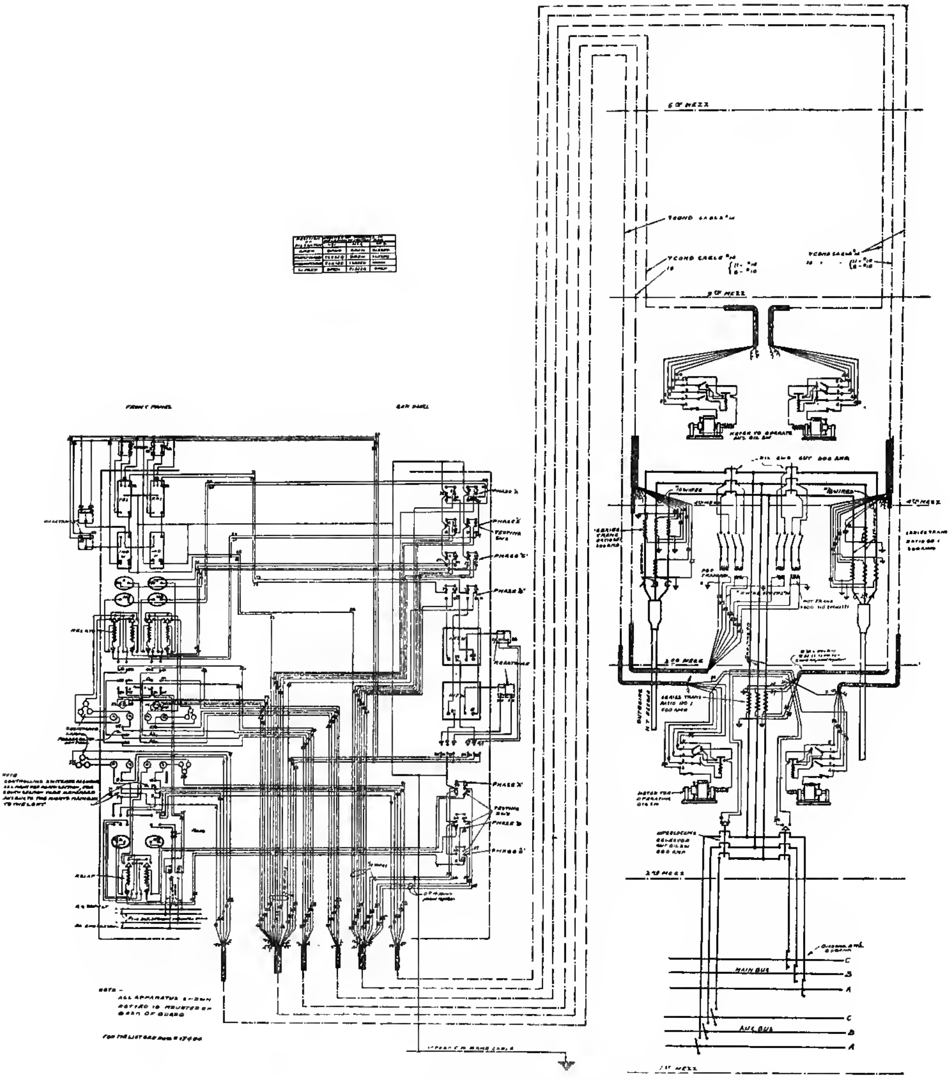
SECTIONS THROUGH WALLS OF ELECTRICAL GALLERIES.



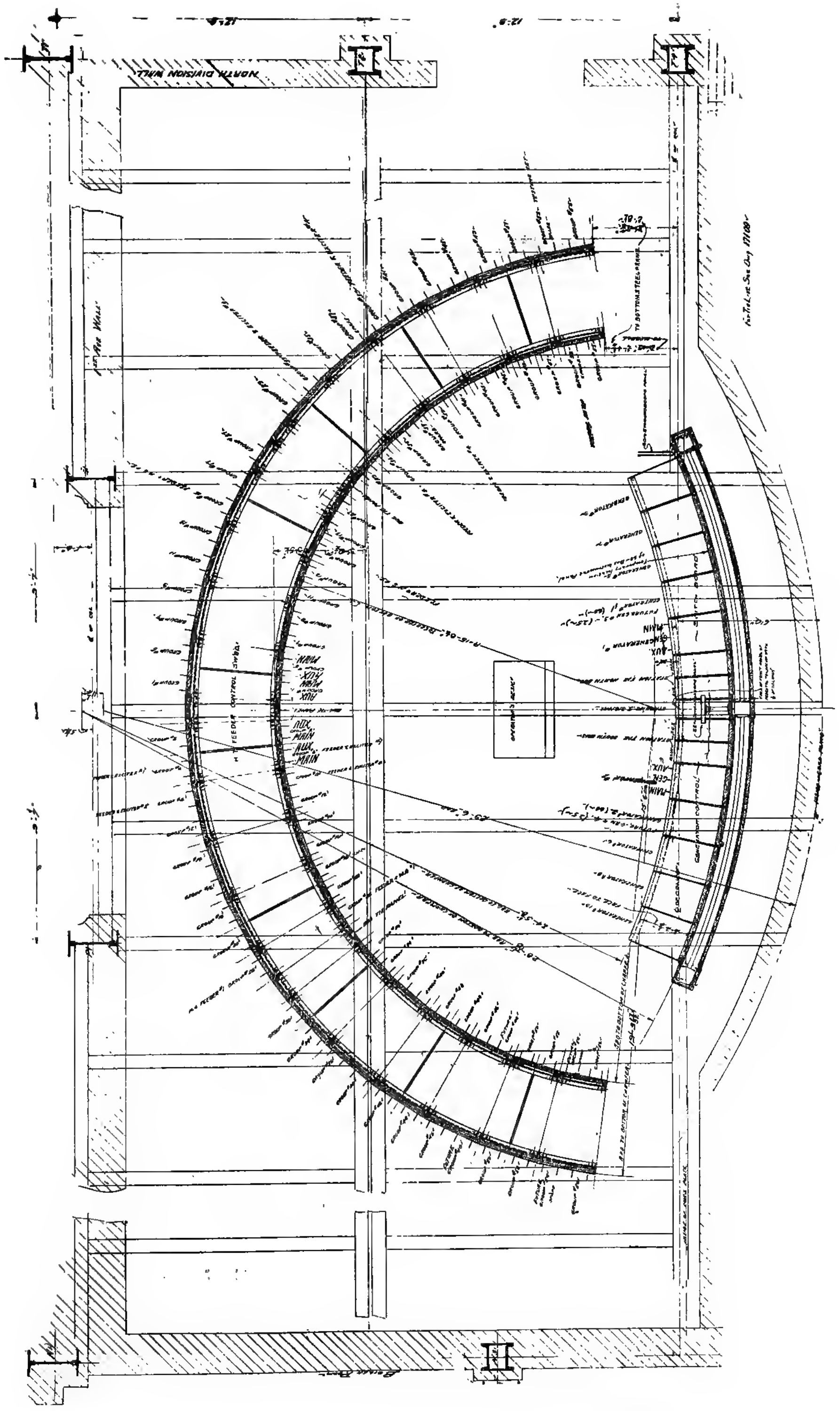
TYPICAL DIAGRAM OF HIGH TENSION CIRCUITS.



WIRING DIAGRAM OF TWENTY-FIVE-CYCLE HIGH TENSION GENERATOR PANEL.



WIRING DIAGRAM OF TWENTY-FIVE-CYCLE HIGH TENSION FEEDER PANEL.



PLAN HIGH TENSION CONTROL BOARDS.

1 Top of pedestal 30" x (18 5/16" to 20 3/16") x 2".

1 Back upper pedestal 12" x 20⅛" x 2".

1 Back lower pedestal 23¾" x 20⅛" x 2".

1—500-ampere Weston ammeter and shunt.

2 H. E. ammeters 2,000-amp. scale.

1 H. E. voltmeter 8,000-volt scale and 150-volt winding.

1 H. E. 3-phase indicating wattmeter, 22,000-k. w. scale

1 H. E. power factor indicator, 110-volt, 60-100-60%.

1 Balanced 3-phase induction recording wattmeter, rectangular pattern.

2 lamp sockets cat. No. 50,798 for mounting on front of panel. One for overload lamp and one for synchronizing lamp.

3 S. P. D. T. control switches, one for main generator "H" oil switch and two for generator selector "H's."

6 Bull's eye indicating lamps, sockets, 3 green and 3 red bull's eyes.

1—4-point synchronizing receptacle.

2 Engine governor controlling switches, one for the turbine governor and one for the electrically operated field rheostat dial.

5 Bull's-eye indicating lamps, receptacles, and 5 plain bull's eyes.

3 D. P. S. T. 25-amp., 125-volt, form "D" switches with special short handles, one for synchronizing lamps, one for D. C. feed to generator "H" and one for D. C. feed to selector "H's."

5 D. P. D. T. 25-amp., 125 volt, form "D" switches with special short handles, four for short circuiting secondaries of four generator current transformers, and one for D. C. supply.

1 D. P. overload instantaneous relay for lighting an overload lamp. The relay is to have one standard coil and the other wound for 1.73 times the standard.

1 T. P. S. T., 25-amp., 125-volt, form "D" switch with short handle for opening potential leads to the recording wattmeter.

4—2,000 ampere current transformers, type S, form E 15, ratio 400:1.

3 T. P. S. T. 1,200-amp., 6,600-volt, form H-3 oil switches with 8″ pots and 220-volt motors with terminals and top channels but without cell doors, cell barriers, tie rods, top and bottom soap stone slabs.

2—6,600 to 110-volt, 200-volt potential transformers.

2 S. P. S. T. 500-ampere electricially operated field switches with discharge clips and resistance.

Special D. P. D. T. control switch for controlling electrically operated field switches See N. Y. E. Dr., No. 17,959.

5 S. P. S. T. signal switches. See Dr. No. 16,692.

20 pairs of H. W. John Manville Co.'s fuse clips.

18 Name plates as indicated.

5—6,600 volt disconnecting switches and fuses for potential transformers with insulators but without bases, special design.

6 S. P. S. T. type L, form G-4, disconnecting switches for 1,200 amp. 6,600 volts with insulators but without bases.

ITEM NO. 2: FEEDER CONTROL.

20—3-phase, 4-circuit feeder panels.

Capacity 4 circuits, 300 amperes, 6,600 volts each.

Size: Front Top 36″ x 24″ x 2″.
Middle 34″ x 24″ x 2″.
Bottom 37″ x 24″ x 2″.
Back, top, 36″ x 29⅞″ x 2″.
Middle 34″ x 29⅞″ x 2″.
Bottom 37″ x 29⅞″ x 2″.

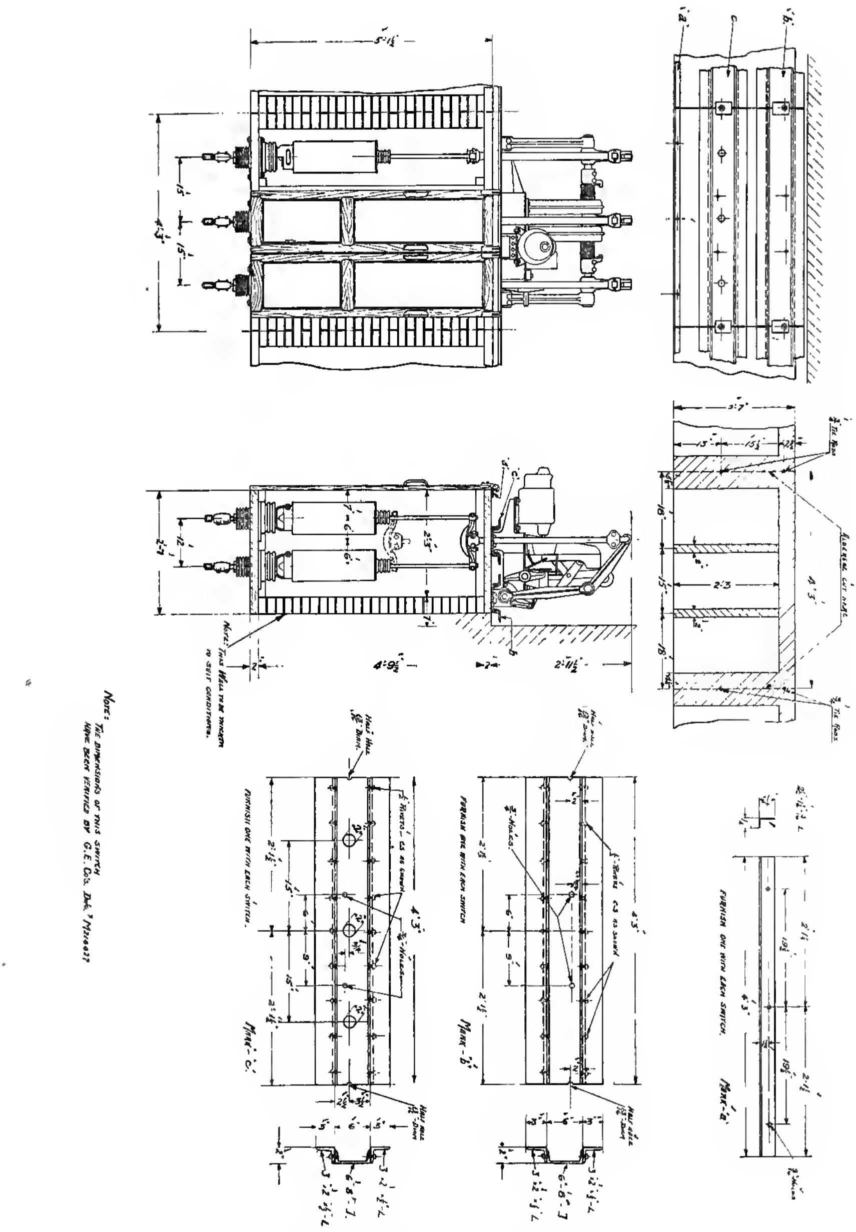
EQUIPMENTS PER PANEL.

4 Vertical edgewise 60-100-60% power factor indicators, 110 volts, 5 amp.

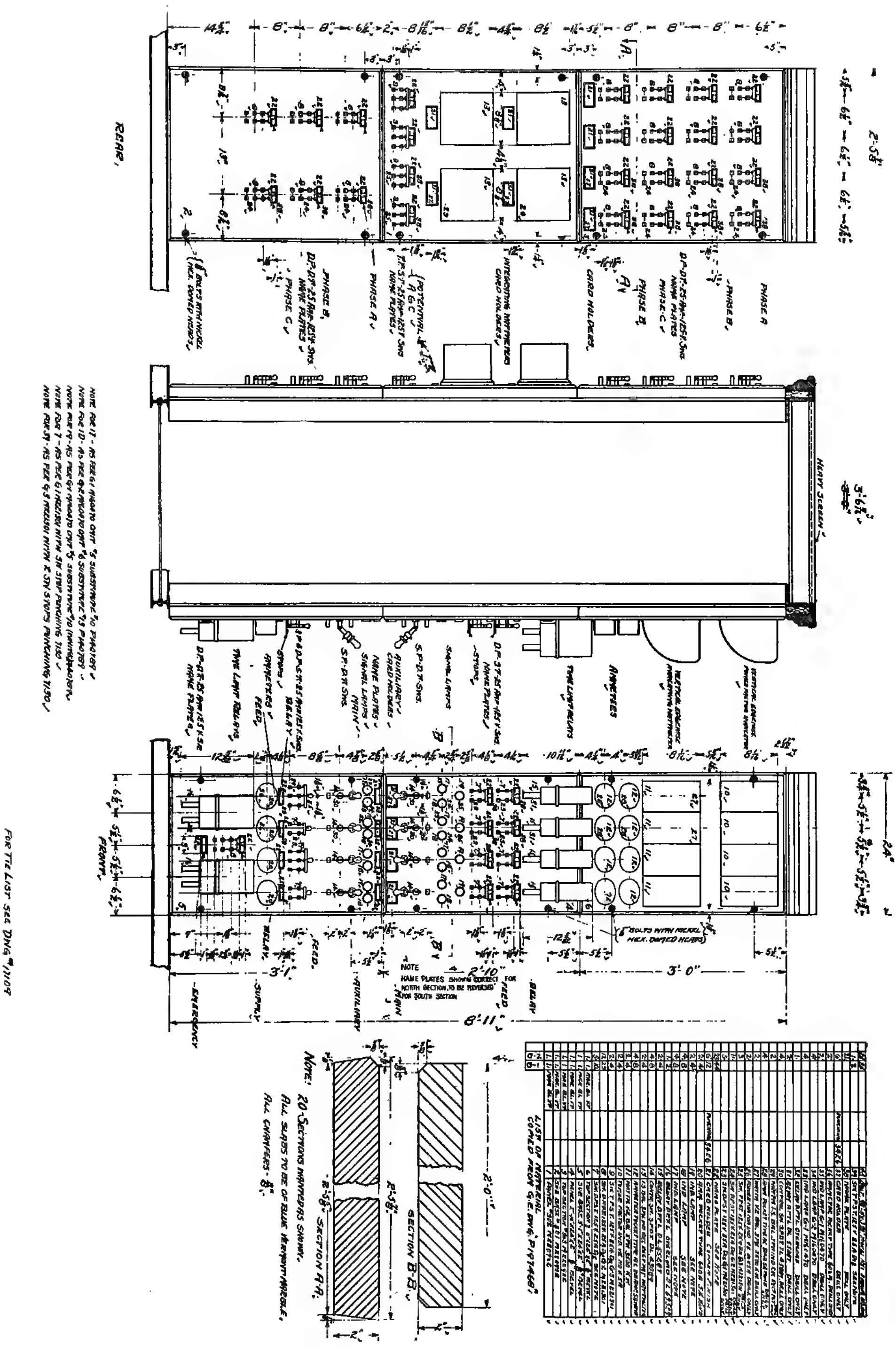
4 Vertical edgewise balanced 3-phase indicating wattmeters, scale 0-3500 k. w.

4 Pocket type A. C. ammeters, 300-ampere scale, 5-ampere winding.

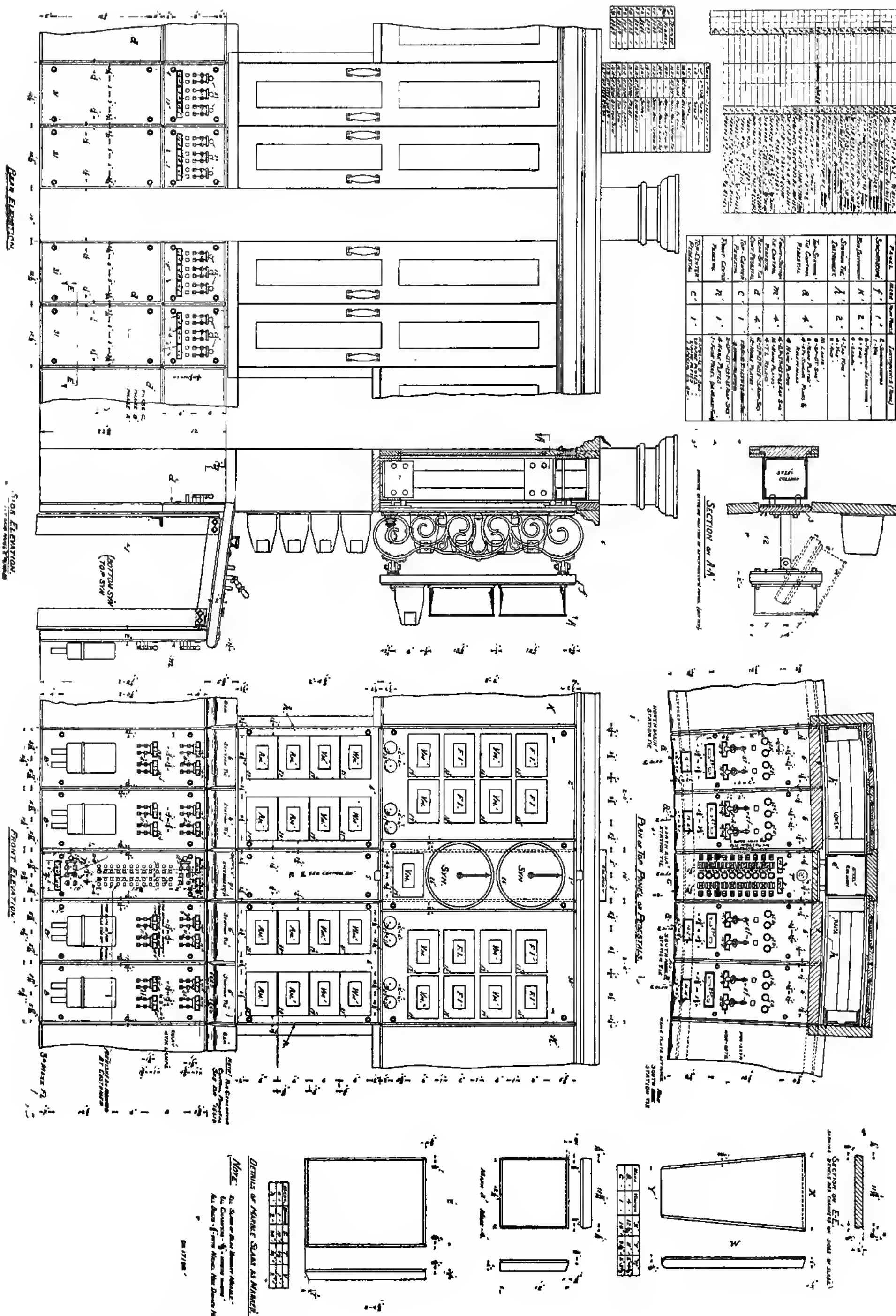
4 Pocket type ammeters, 300 ampere scale, 10-ampere winding.



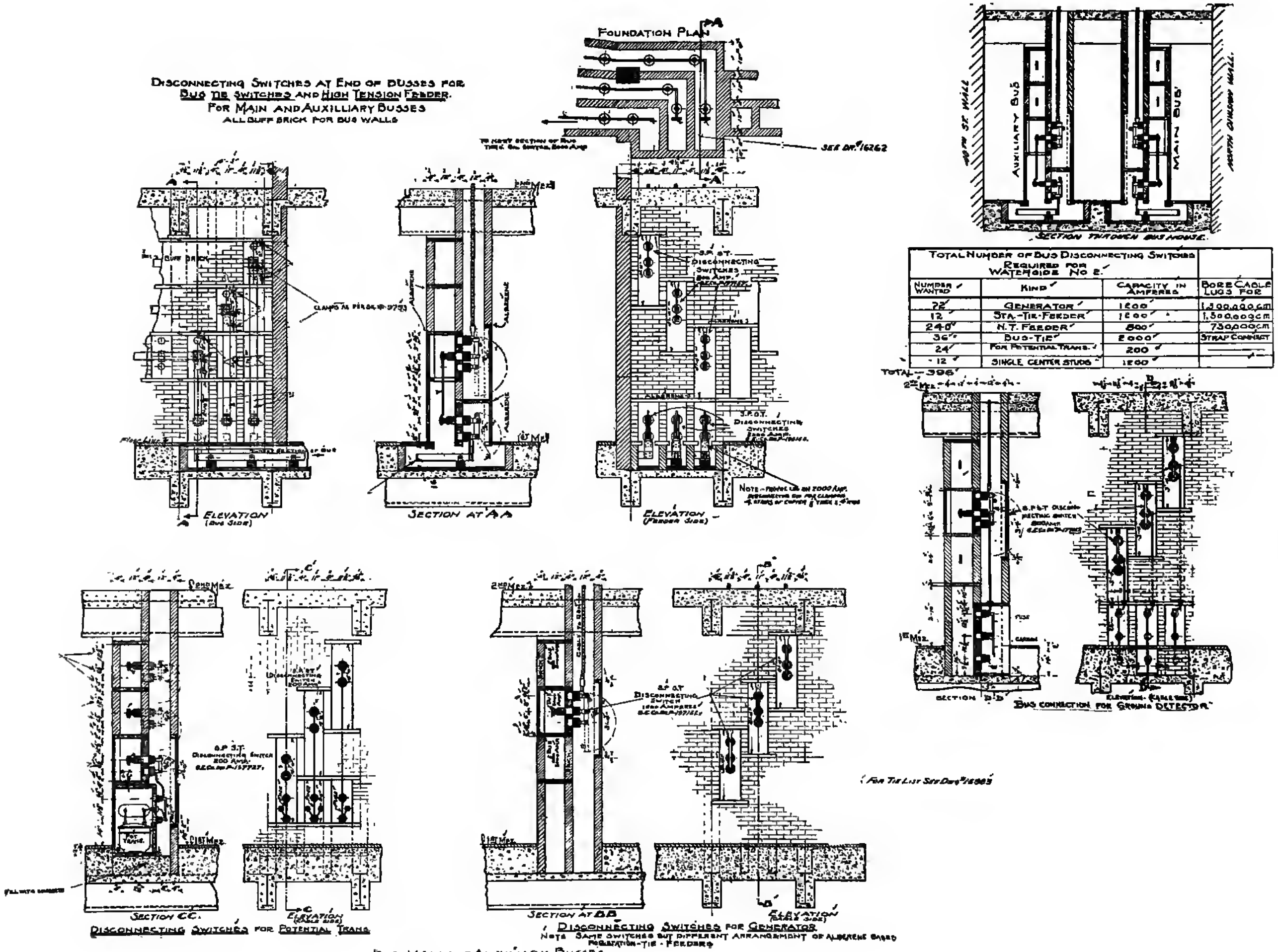
OIL SWITCHES FOR HIGH TENSION FEEDERS AND GENERATORS.



HIGH TENSION TWENTY-FIVE CYCLE FEEDER CONTROL BOARD.



HIGH TENSION STATION TIE CONTROL AND SYNCHROSCOPE PANEL.



TOTAL NUMBER OF BUS DISCONNECTING SWITCHES REQUIRED FOR WATERSIDE NO 2.

NUMBER WANTED	KIND	CAPACITY IN AMPERES	BORE CABLE LUGS FOR
72	GENERATOR	1200	1,300,000 cm
12	STA.-TIE-FEEDER	1200	1,500,000 cm
240	H.T. FEEDER	800	750,000 cm
36	BUS-TIE	2000	STRAP CONNECT
24	FOR POTENTIAL TRANS.	200	
12	SINGLE CENTER STUDS	1200	

TOTAL—396

DISCONNECTING SWITCHES FROM HIGH TENSION BUSES.

16 Current transformers, 300-ampere, D-20, ratio 60:1.

8—200-watt potential transformers, 6,600/110-volt.

16 Fuses for above transformers with 6,600 volt disconnecting switches, without bases. Special. See Dr. No. 15,523.

4 D. P. time limit overload relays, diaphragm type, to be mounted edgewise to board. Covers removable toward front. One special coil to take 1.73 times normal current.

8 D. P. S. T. special 25-ampere, 250-volt, form D-2 lever switches with 125-volt spacing, short handles and stops.

16 D. P. D. T. special 25-ampere, 250-volt, form D-2 lever switches with 125-volt spacing and short handles.

4 Balanced 3-phase induction recording wattmeters, rectangular pattern, for mounting on the rear panels.

12 indicating lamps and sockets.

4 White bull's-eyes.

4 Red bull's-eyes.

4 Green bull's-eyes.

4 T. P. S. T. special 25-ampere, 250-volt, D-2 switches, with 125-volt spacing, short handles and stops.

4 S. P. D. T. controlling switches.

4 T. P. S. T. 300-ampere, 6,600-volt, 8" pot, form H-3 oil switches with 220-volt motors, terminals and without cell doors, cell barriers, tie rods, top and bottom soapstone slabs.

SELECTOR SECTION.

8 Indicating lamps and sockets.

4 Red bull's-eyes.

4 Green bull's-eyes.

2 T. P. S. T. special 25-ampere, 250-volt, form D-2 lever switches with 125-volt spacing, short handles and stops.

4. S. P. D. T. controlling switches.

2 D. P. S. T. special 25-ampere, 250-volt, form D-2 lever switches with 125-volt spacing, short handles and stops.

7 D. P. D. T. special 25-ampere, 250-volt, form D-2 lever switches with 125-volt spacing and short handles.

2 Pocket type ammeters, 600-ampere scale, 5-ampere winding.

2 Pocket type ammeters, 600 amp. scale, 10 amp. winding.

6 Current transformers D-20, 600-ampere capacity ratio 120 : 1.

2 D. P. overload time limit relays, diaphragm type, mounted flat on panel. Covers removable toward front. One special coil to take 1.73 times normal current.

4 T. P. S. T. 500-ampere, 6,600-volt, form H-3 oil switches with 8″ pots and 220-volt motors, terminals, and without cell doors, cell barriers, tie rods, top or bottom soapstone slabs.

12—6,600-volt, 800-ampere S. P. S. T. disconnecting switches with locking devices. Bases will be supplied by customer.

Item No. 2 a:

2—3-phase, 2-circuit feeder panels. Size to be as follows:

Size: Front, 36″ x 13″ x 2″, 34″ x 13″ x 2″, and 37″ x 13″ x 2″.

Back, 36″ x 16⅛″ x 2″, 34″ x 16⅛″ x 2″, and 37″ x 16⅛″ x 2″.

Equipment per panel to consist of one-half the apparatus specified in Item No. 2.

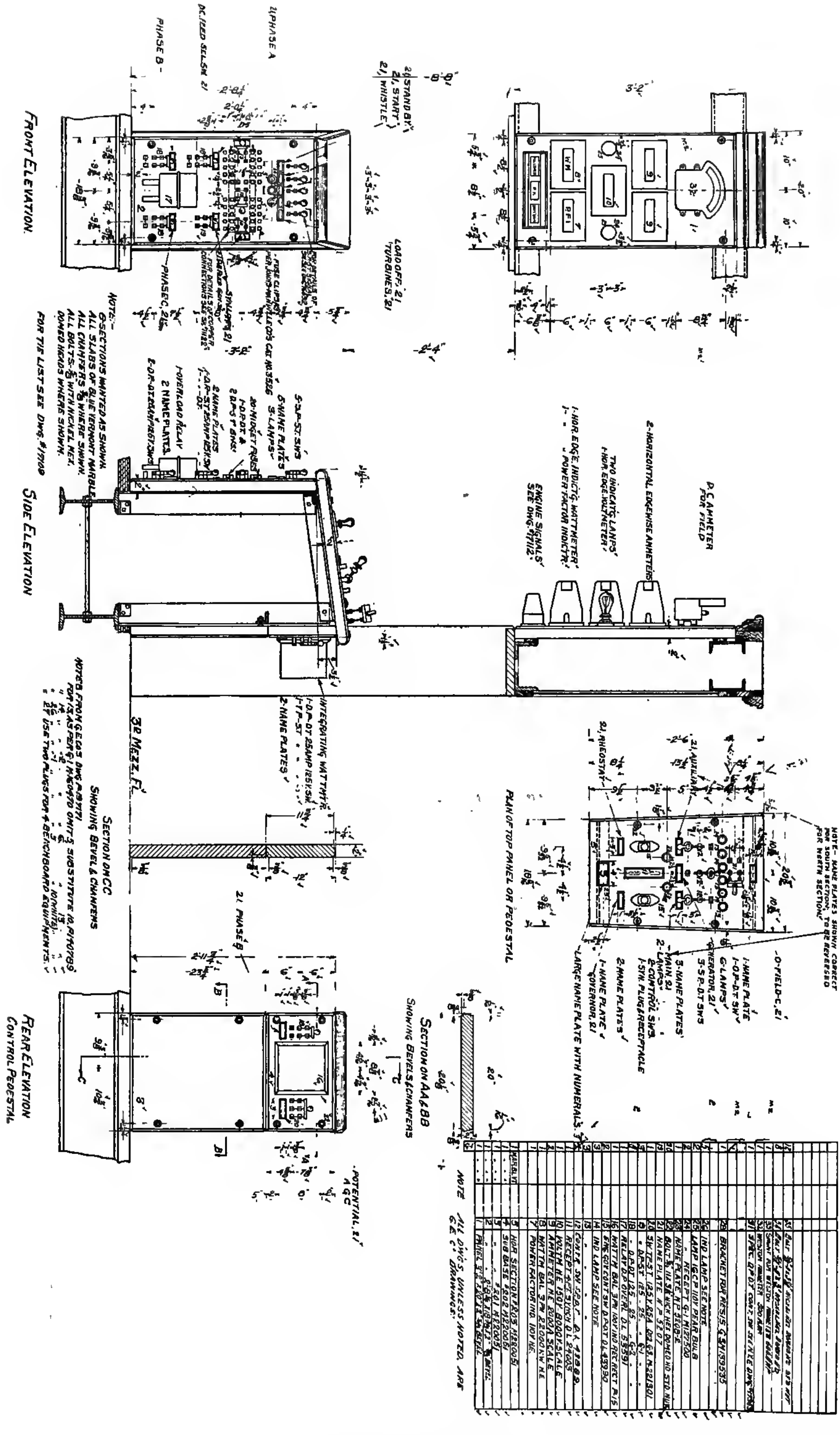
Item No. 3: Bus Tie Control.

2000 ampere bus section tie equipment. Total consisting of:

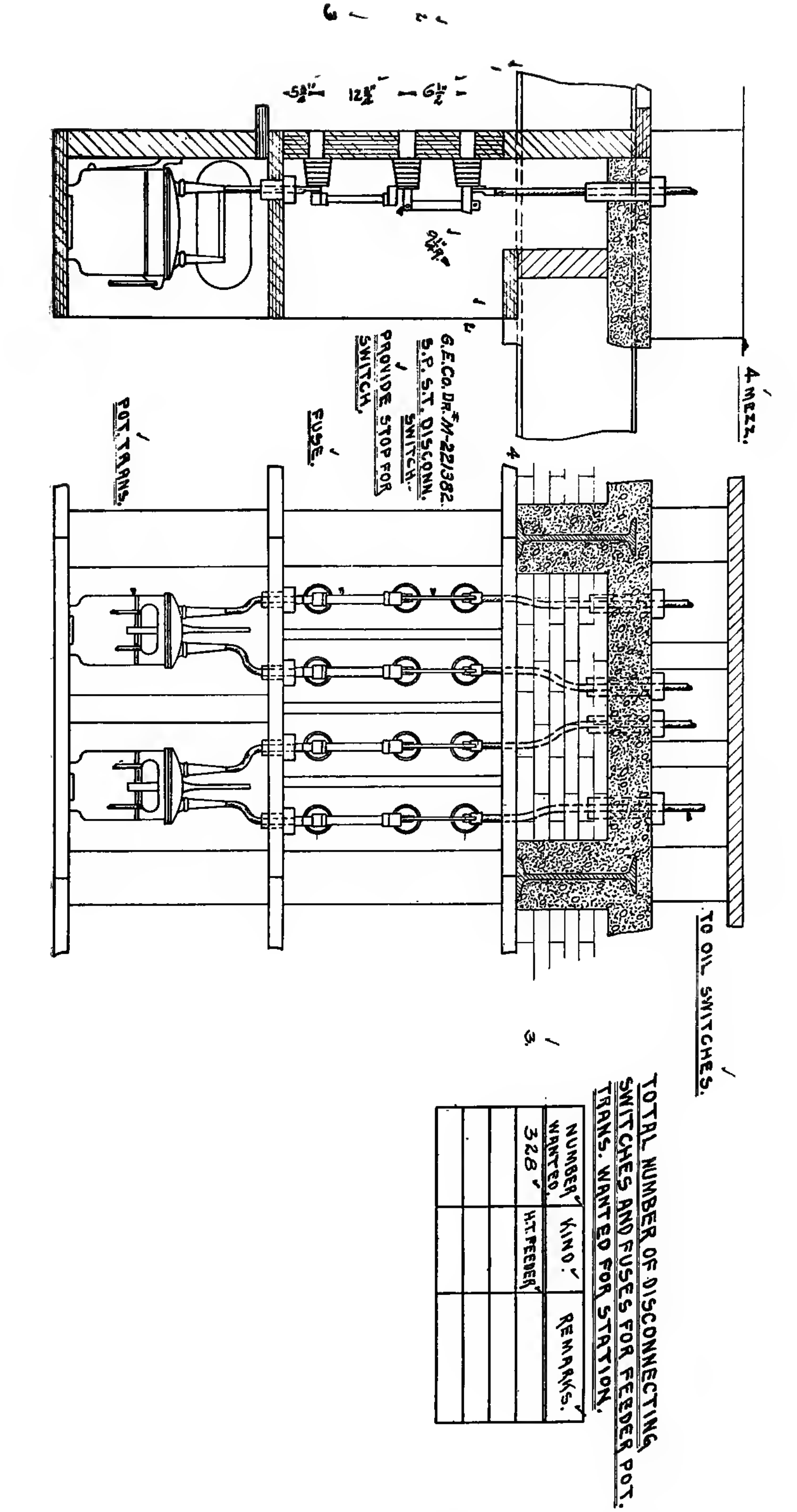
3 Blue Vermont marble panels.

Size: Front, top, 36″ x 10″ x 2″.
Middle, 34″ x 10″ x 2″.
Lower, 37″ x 10″ x 2″.
Back, top, 36″ x 12 7/16″ x 2″.
Middle, 34″ x 12 7/16″ x 2″.
Lower, 37″ x 12 7/16″ x 2″.

6 T. P. S. T. 2,000-ampere, 6,600-volt, form H-3 oil switches with 8″ pots and 220-volt motors, terminals, and



TWENTY-FIVE CYCLE GENERATOR PEDESTAL AND INSTRUMENT CONTROL.



DISCONNECTING SWITCHES FOR FEEDER POT TRANSFORMERS.

without cell doors, cell barriers, tie rods, and top and bottom soapstone slabs.

6 S. P. D. T. controlling switches.

24 Indicating lamps and sockets.

12 Plain bull's-eyes.

6 Red bull's-eyes.

6 Green bull's-eyes.

8—6,600/110-volt, 200-watt potential transformers.

3 D. P. D. T. special 25-ampere, 250-volt, D-2 switches with 125-volt spacing and short handles.

36—6,600-volt, 2,000-ampere S. P. S. T. disconnecting switches with locking devices. Bases will be supplied by customer.

8 H. E. frequency indicators for 25-cycle circuit.

16 Fuses and 6,600-volt disconnecting switches for potential transformers, without bases.

8 H. E. volt meters, scale 5,000-7,500.

6 D. P. S. T. special 25-ampere, 250-volt, form D-2 switches with 125-volt spacing, short handles and stops.

10 name plates as indicated.

ITEM NO. 4: SYNCHROSCOPE.

2 Synchronism indicators, 13″ diameter on panel as shown on drawing No. 15,732.

1 350-volt H. E. voltmeter.

1 D. P. D. T. special 25-ampere, 250-volt, D-2 switch with 125-volt spacing and short handle.

ITEM NO. 5: STATION TIE CONTROL.

Station tie equipment, total consisting of blue Vermont marble panels as follows:

1—38″ x 14″ x 2″.

2—38″ x 24″ x 2″.

1—28⅜″ x 10″ x 1″.

1—38″ x 10″ x 1″.

4—28⅝″ x (12 1/16″ to 11″) x 2″.

1—27⅝″ x (10″ to 9⅛″) x 2″.

4—32¼″ x 11 1/16″ x 2″.

1—32¼″ x 9 3/16″ x 2″.

4—12″ x 12 1/16″ x 2″.

4—23¾″ x 12 1/16″ x 2″.

Framework to be supplied by the Company.

8 T. P. S. T. 1,200-ampere, 6,600-volt, form H-3 oil switches with 8″ pots, 220-volt motors, terminals, and without cell doors, cell barriers, tie rods, top or bottom soapstone slabs.

8 S. P. D. T. controlling switches.

16 Indicating lamps.

16 Indicating lamp sockets.

8 Green bull's-eyes.

8 Red bull's-eyes.

12 Current transformers, 1,500 ampere, ratio 300 : 1.

4 D. P. overload time limit relays, diaphragm type, with one special coil to take 1.73 times normal current.

8 H. E. ammeters, 0-1,500 amperes.

4 Indicating wattmeters, balanced 3-phase. Scale, 18,000-0-18,000 k. w. zero in centre of scale.)

12—6600 Volt disconnecting switches and fuses for potential transformers. Bases to be supplied by customer.

8—6,600/110-volt, 200-watt potential transformers.

4—4-point synchronizing receptacles.

2—4-point synchronizing plugs.

16 D. P. D. T. special 25-ampere, 250-volt, D-2 switches with 125-volt spacing and short handles.

8 Lamp sockets, cat. No. 50,798.

4 D. P. S. T. special 25-ampere, 250-volt, D-2 switches with 125-volt spacing, short handles and stops.

12—1,200-ampere 6,600-volt disconnecting switches with locking devices, without bases.

4 H. E. voltmeters, 5,000 to 7,500 volts.

12 D. P. S T. special 25-ampere, 250-volt, D-2 switches with 125-volt spacing and short handles.

3—6,600-volt disconnecting switches and separate fuses for bus potential transformers.

8 Lamp sockets, cat. No. 50,798, for overload lamp and syn. lamp.

84 Reversed etched name plates as indicated.

All switches, instruments, relays and panels here specified are to be mounted on steel frames furnished by the Company in accordance with the Company's Drawings No. 17532, 17171, 15732 and 15618.

CABLES.

Control of Generators.

These specifications include the furnishing of the generator, field and control cables, and installing the same; also the installation of the generator oil switches, solenoid switches, current and potential transformers and disconnecting switches for each unit, as indicated in wiring diagram of H. T. generator panel Dr. No. 16057.

The control cables comprise per unit:

2 Seven-conductor No. 14 wire cables for the control of the "H" oil switches on the 2nd and 4th Mez. floor.

1 Nineteen conductor cable of 8—No. 10 wires and 11—No. 14 wires for connecting the potential and current transformers with the controlling board.

1 Nineteen conductor cable, No. 14 wires, between the generator and control board, for the engine signal and governor control device.

1 Twelve conductor cable, No. 14 wires for controlling the electricity operated field rheostats located on the 1st floor electrical gallery.

The generator cables comprise per unit:

3—1,500,000 c. m. cables, cotton covered from terminal board on the generator to the end bell at the base of the generator foundation, lead covered from end bell in the foundation to the end bell in wall of 3rd Mez. electrical gallery; cotton covered from this point to the bus disconnecting switches.

2—400,000 c. m. cables for the field circuit.

1 No. 6 duplex cable for the field ammeter circuit.

Feeder Control.

These specifications include the furnishing of the necessary control and feeder cables up to the H. T. triplex feeder end bell

on the 3rd Mez. as indicated in the wiring diagram of H. T. feeder panel, Dr. No. 16058 and 16584; also the installation of the H. T. feeder oil switches, the current and potential transformer and the disconnecting switches and fuses necessary for each group of feeders.

The control cables comprise per group:

4 Seven conductor, No. 14 wire cables for the control of the "H" oil switches.

2 Nineteen conductor, (11—No. 14 and 8—No. 10 wires) cables for connecting the current and potential transformers with the H. T. feeder control board.

In addition for the H. T. feeder control of motor generators and exciters, there shall be furnished:

1 Seven conductor, No. 14 wire control cable for interconnecting instruments and signal lamps on exciter board with the H. T. feeder control panel.

The feeder cables comprise:

3—500,000 c. m. cables, extending from the bus disconnecting switches to the 300 ampere "H" oil switches on the 4th Mezzanine.

6—250,000 c. m. cables, extending from the "H" oil switch on the 4th Mez. to the H. T. triplex feeder end bell on the 3rd Messanine.

Station Tie Control.

These specifications include the furnishing of the necessary control cables and station tie cables up to the point where they enter the H. T. end bell on the 3rd Mezzanine, as indicated in wiring diagram of H. T. station tie and synchroscope panel Dr. No. 16156.

The control cables comprise:

2 Seven conductor No. 14 wire cables for controlling the "H" oil switches.

1 Seven conductor No. 14 wire cable for connecting the bus potential transformers and the bus instrument panel.

1 Nineteen conductor No. 14 wire cable for connecting the

potential and current transformers with the station tie control panel.

The station tie cables comprise:

3—1,000,000 c. m. cables extending from the busses up to the point where they enter the H. T. end bell on the 3rd Mezzanine floor.

Bus Tie Control.

There shall be furnished for each pair of bus tie oil switches, control cable as follows:

1 Twelve conductor No. 14 wire control cable for controlling each pair of 2.000 Amp. bus tie oil switches.

SPECIFICATIONS FOR CABLES.

The cables to be used are as follows:

1,500,000 c. m. cable, 10/32" varnished cambric insulation, 1/8" lead of 2% tin.

1,500,000 c. m. cable, 37/19 wires 10/32" varnished cambric insulation, 1 cotton braid, waxed.

1,000,000 c. m. cable 10/32" varnished cambric, 1 cotton braid, waxed.

500,000 c. m. cable of 127 wires 10/32" varnished cambric 1 cotton braid waxed test voltage 20,000 volts for 1 hr. after 72 hrs. immersion.

400,000 c. m. cable 4/32" varnished cambric, lead covered field cables.

250,00 c. m. cable 10/32" varnished cambric, 1 cotton braid waxed.

2/0 Rheostat wire, 415—No. 25 B & S. gauge wires 3/32" varnished cambric, 1 cotton braid painted, and 1 asbestos braid painted.

No. 6 Duplex cable for field ammeter circuit 5/64" rubber, 1/16" lead.

The control cables to be used are as follows:

19 conductor cable of eight No. 10 wires and eleven No. 14 wires, 3/32″ rubber over each wire, one tape over all and 5/64″ lead.

19 conductor cable No. 14 wires 2/32″ rubber over each wire, two tapes, 5/64″ lead.

12 conductor No. 14 wire cable 2/32″ rubber, two tapes 5/64″ lead.

7 conductor No. 14 wire cable 2/32″ rubber, two tapes 5/64″ lead.

NOTE:

The 2% tin applies to lead sheaths of all H. T. cables but does not apply to control cables.

SPECIFICATIONS

Accompanied by drawings for the

Electrical Apparatus for Control of 60 Cycle Generators

of the new Waterside Power Station

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. Being part of a contract between the General Electric Company, Contractors, and The New York Edison Company.

GENERAL:

Panels are to be of Blue Vermont Marble.
Instruments are to have marine finish.
The equipment will comprise the following:

ITEM NO. I: GENERATOR CONTROL.

2 Generator control stands, each for controlling a 7500 V. 7500 K. W. 60 cycle, 3-phase generator. Panels to be of blue Vermont marble. Instruments to have marine finish.

SIZE:

Each stand will be comprised of the following sections, the dimensions being:

18⅜" x 32¼" x 2", front of pedestal.

20⅛" x 23¾" x 2", lower back of pedestal.

12" x 20⅛" x 2", upper back of pedestal.

30" x (18 5/16" to 20 3/16") x 2", top of pedestal.

20" x 38" x 2", instrument panel.

—Equipment for each control stand—

1—9000 V. H. E. voltmeter with 150 V. winding.

2—1200 amp. H. E. A. C. ammeters.

1—60-100-60% H. E. Power factor indicator.

1—16000 k. w. H. E. polyphase indicating wattmeter.

1 Polyphase induction recording wattmeter rectangular pattern for mounting on back of control stand.

5 Type S, Form E-15 current transformers, 1500 amperes, ratio 300 : 1.

3—200 Watt potential transformers, 6600/110 Volts.

1 D. P. Overload instantaneous relay, to be used with indicating lamps and to have one standard coil and one special coil to take 1.73 times current of the standard coil.

1—500 amp. Weston ammeter for field circuit.

2 S. P. S. T. 250 V. 500 amp. electrically operated field switches with discharge clips.

1 D. P. D. T. 125 V. Type C, Form G2, controlling switch for electrically operated field rheostat.

1 D. P. D. T. 25 amp. 125 V. Type C, Form G2, Engine governor control switch.

1—4 pt. synchronizing receptacle and plug.

2 Lamp Sockets, cat. No. 50798 for mounting on instrument panel.

6 Bulls-eye indicating lamp receptacles, each with 8 c. p. candelabra lamp.

3 Red Bull's-eyes.

3 Green Bull's-eyes.

3 D. P. S. T. 25 amp. "D" switches with handle 1" long, one for synchronizing lamps, one D. C. feed to generator "H" and one for D. C. feed to selector H's.

5 D. P. D. T. 25 amp. "D" switches with 1" handles for short circuiting current transformers.

1 D. P. D. T. Control switch for controlling electrically operated field switch, special, see Dr. No. 17959.

1 T. P. S. T. 25 amp. "D" switch for disconnecting potential leads from recording wattmeter.

5—6600-Volt disconnecting switches and fuses for potential transformers without bases. Special, see Dr. No. 15398.

20 sets of standard fuse clips unmounted John's Manville Co's cat. No. 3526.

5 Bull's-eyes indicating lamp receptacles, each with fuses and lamp same as above.

5 White bull's-eyes.

3 S. P. D. T. Controlling switches for generator "H" switches.

6 S. P. S. T., Type L, Form G-4, 1200 amp. 6600 V. disconnecting switches, with locking devices and insulators but without bases.

3 T. P. S. T. 6600 V., 1200 amp., Form H-3 oil switches with 8″ pots and 220 V. motors, with terminals and top channels but without cell doors, cell barriers, tie rods, top or bottom soapstone slabs.

Name plates as indicated on Dr. No. 17648.

The specifications relative to the furnishing the 60-cycle generator and field cables, and respective sizes of same and their installation are the same as for the 25-cycle units.

Item No. 2: Feeder Section:

2—4 circuit feeder panels.

Capacity 7500 V. 300 mp. per circuit without framework.

Size: Front 36″ x 24″ x 2″
34″ x 24″ x 2″.
37″ x 24″ x 2″.
Back 36″ x 29⅞″ x 2″.
34″ x 29⅞″ x 2″
37″ x 29⅞″ x 2″.

— Equipment per panel. —

4—60-100-60% vertical edgewise power factor indicators, 125 V., 5 amp.

4—4000 k. w. V. E. polyphase indicating wattmeters.

4—300 amp. pocket type A. C. ammeters with 5 amp. winding.

4—300 amp. pocket type ammeters with 10 amp. winding.

4 polyphase induction recording wattmeters, for mounting on back panel.

20 D-20 current transformers, 300 amps.

8—200 watt potential transformers, 6600/110 Volt.

4 D. P. overload time limit relays, diaphragm type (these relays will be mounted edgewise to the panel, will have split covers and special winding as designated for the relay on the generator panel).

8 D. P. S. T. 25 amp. 125 Volt "D" switches with 1" handles (four for disconnecting D. C. Supply and four for disconnecting relay terminals).

4 T. P. S. T. 25 amp. 125 Volt "D" switches with 1" handles for disconnecting potential leads from recording wattmeters.

20 D. P. D. T. 25 amp. 125 V. "D" switches with 1" handles for short circuiting secondaries of current transformers.

12 Bulls-eye lamp receptacles, each with fuses and lamp as heretofore specified.

4 Red Bulls-eyes.

4 Green Bulls-eyes.

4 White Bulls-eyes.

4 S. P. D. T. Controlling switches.

16—6600 Volt disconnecting switches with fuses for potential transformers, without bases. Special, see Dr. No. 19690.

4 T. P. S. T. 6600 V. 300 amp. H-3 oil switches, with 8" pots and 220 V. motors with terminals and top channels, but without cell doors, cell barriers, tie rods, top and bottom soapstone slabs.

SELECTOR SECTION:

8 Bulls-eye lamp receptacles, each with fuses and lamp as specified in item No. 1.

4 Red Bulls-eyes.

4 Green Bulls-eyes.

4 S. P. D. T. Controlling switches.

2 D. P. S. T. 25 amp. "D" switches with 1" handles and switch stops for disconnecting D. C. supply.

2 D. P. Overload time limit relays, diaphragm type (these relays will have special windings, the same as specified for relay in item No. 1).

2—600 amp. pocket type ammeters with 5 amp. winding.

2—600 amp. pocket type ammeters with 10 amp. winding.

6 D-20 current transformers, 600 amp.

7 D. P. D. T. 25 amp. 125 V. "D" switches (6 for short circuiting current transformers and one for D. C. supply).

12 S. P. S. T. 6600 V. 800 amp. disconnecting switches, with locking devices and insulators but without bases.

4 T. P. S. T. 500 amp. 6600 V. H-3 oil switches with 8" pot and 220 volt motors, with terminals and top channels, but without cell doors, cell barriers, tie rods, top and bottom soap stone slabs.

4 Special 2 point synchronizing receptacles.

2—2 point special synchronizing plugs.

2 T. P. S. T. 25 amp. "D" switches with 1" handles and switch stops for disconnecting relay terminals.

ITEM No. 3:

12 Card holders, copper finish and 48 name plates, copper finish as indicated on Dr. No. 17208.

1 Bus instrument panel of blue Vermont marble.

SIZE:

20" x 38" x 2" without supporting frame work, having mounted thereon:

2—60 cycle H. E. frequency indicators.

2 H. E. voltmeters with 150 V. winding and 4000/9000 V. scale.

2—200 watt potential transformers, 6600/100 V.

4 S. P. S. T. disconnecting switches, 6600 V. and 4 fuses for potential transformers with insulators but without bases.

Item No. 4:

1 Synchroscope panel of blue Vermont marble.

Size:

18″ x 22″ x 1½″ without supporting frame, having mounted thereon:

1—13″ 60 cycle synchroscope.

1 H. E. voltmeter with 150 V. winding and 4000/9000 V. scale.

SPECIFICATIONS

Accompanied by drawings for the

Exciter Switchboard and Main Light and Power Switchboard of Waterside No. 2.

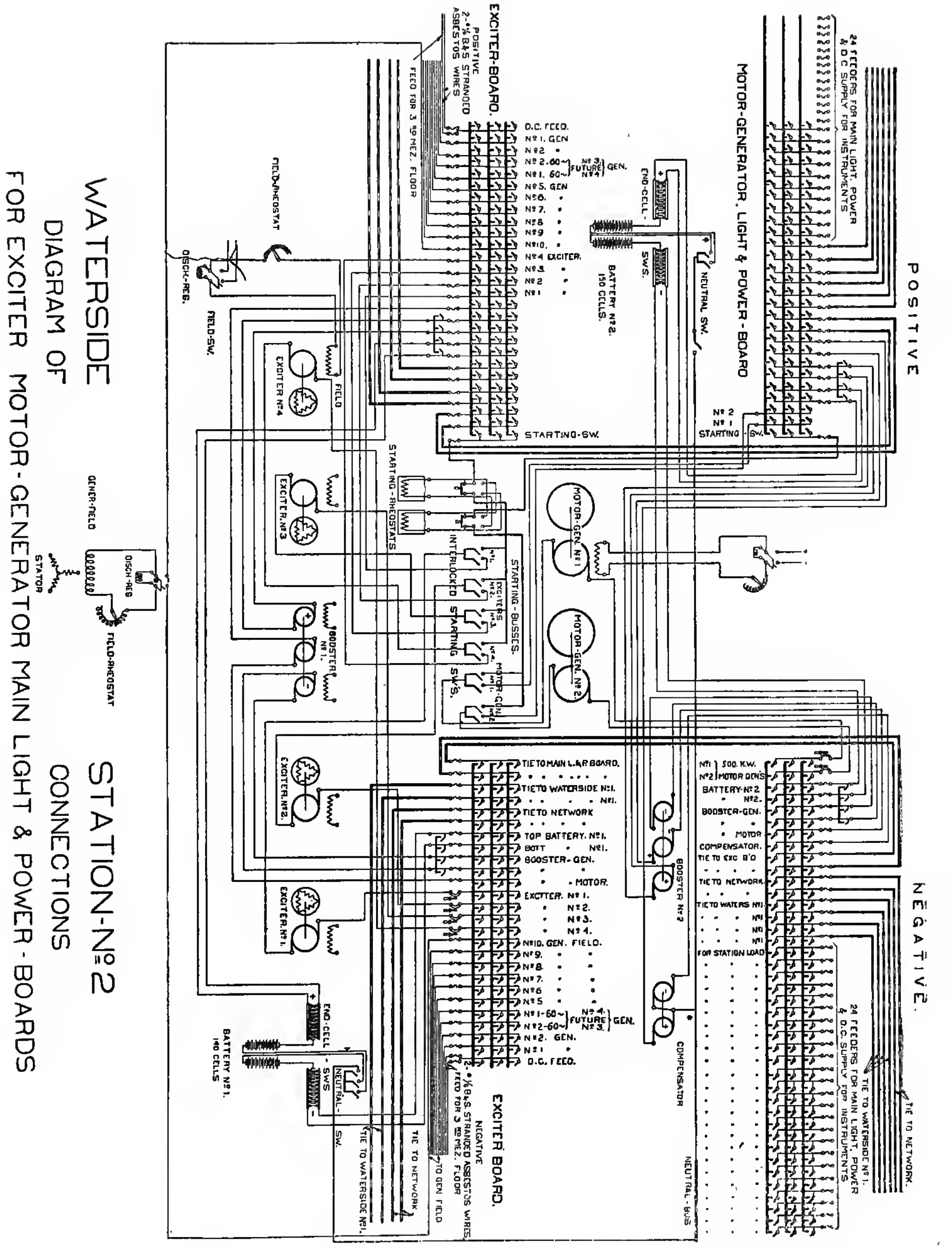
For Control of Four Exciter Sets, Two Motor-Generators, Two Storage Batteries, Two Boosters, One Compensator, Generator Field Circuits and Main Light and Power Circuits.

of the New Waterside Power Station

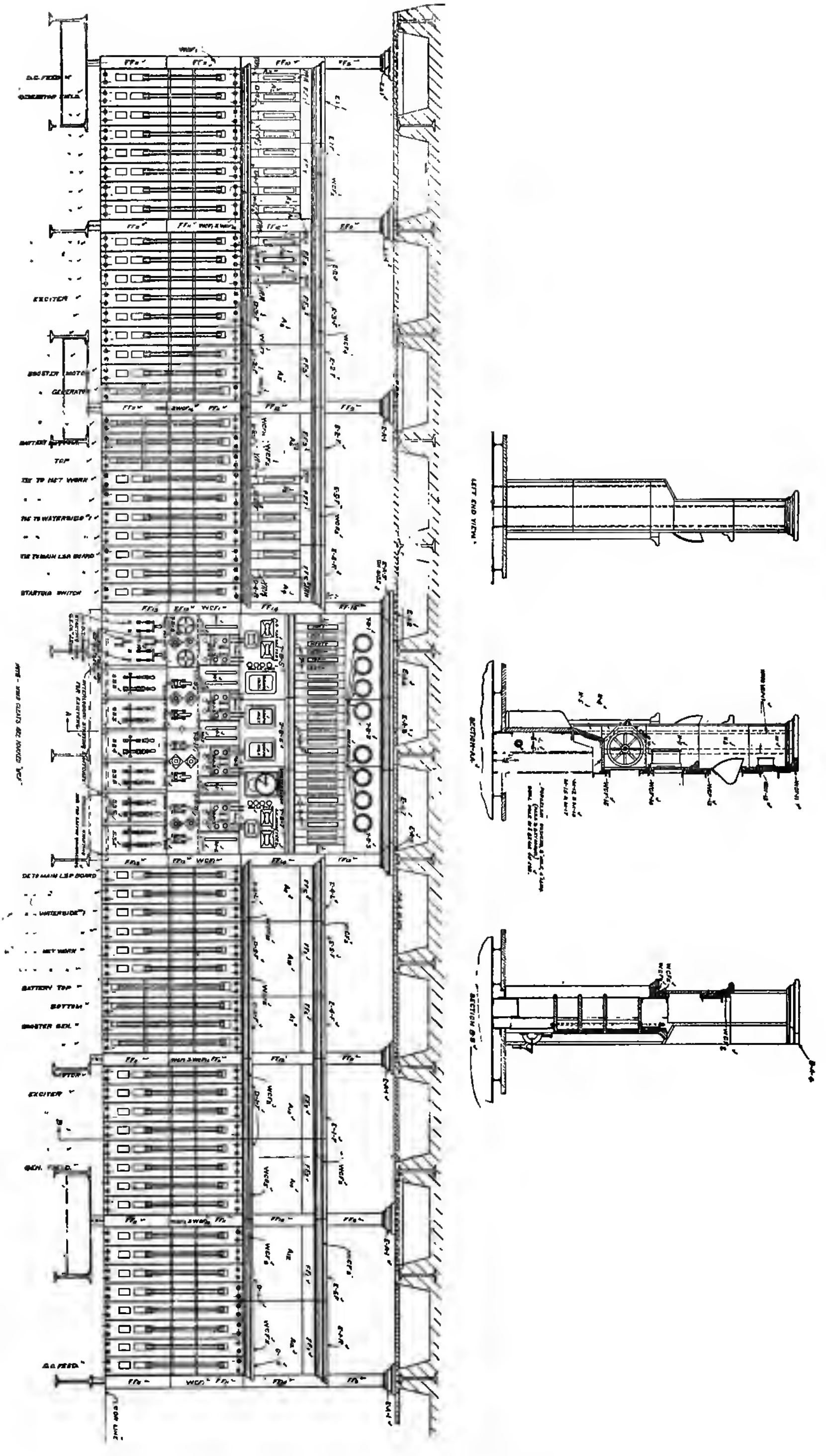
To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. Being a part of a contract between the General Electric Company, and The New York Edison Company.

GENERAL:

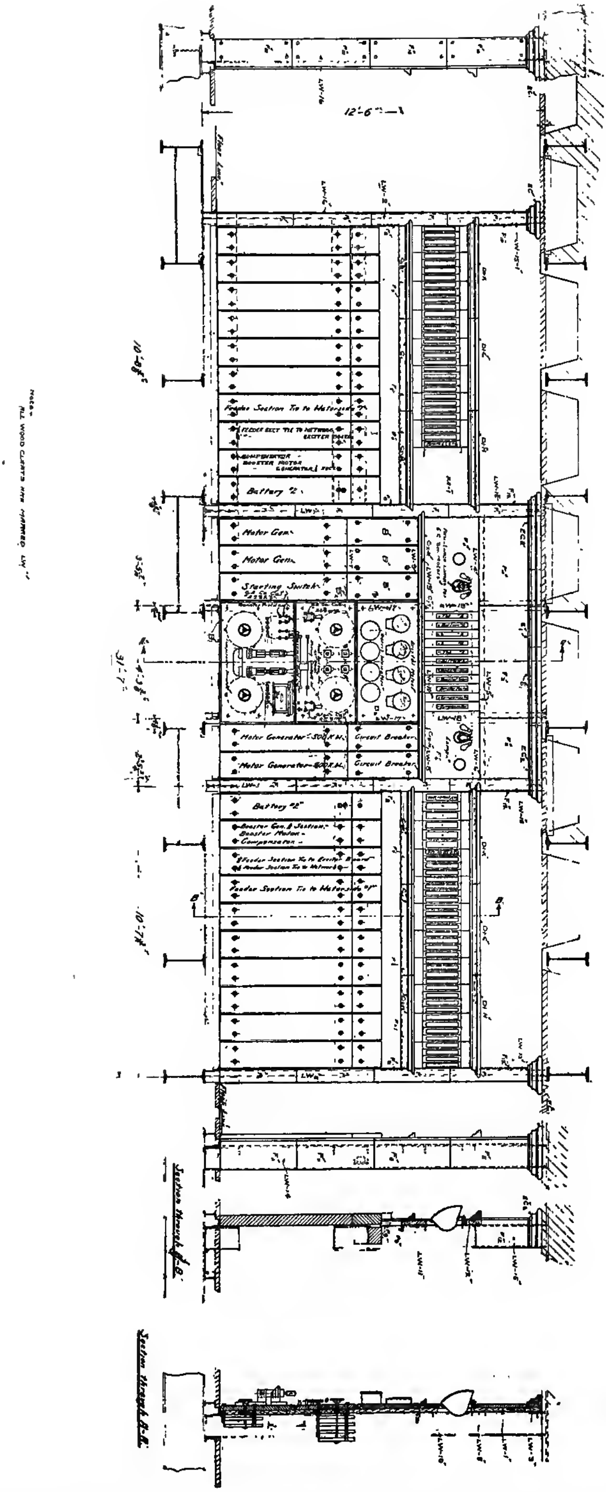
These specifications include the furnishing and erecting in the Company's Waterside Power Station, two direct current switchboards complete, including steel frames, panels, mouldings, busses, switches, instruments and connections as indicated on detailed drawings furnished by the Company and forming part of these specifications. These switch boards shall be known as the Exciter Board and the Main Light & Power Board.



WIRING DIAGRAM EXCITER AND LIGHT AND POWER BOARDS.



ELEVATION EXCITER BOARD.



ELEVATION MOTOR GENERATOR BOARD AND LIGHT AND POWER BOARD.

THE EXCITER BOARD.

The exciter board for the purposes of these specifications may be divided into two sections, viz.:

I. The Control or Starting section; and,

II. The Bus. section, position and negative.

I. Control and Starting Section.

The control or starting section of this board shall consist of selected slate panels, with blue Vermont marble finish and of dimensions given in detailed drawings furnished by the Company, and shall have mounted thereon the following complement of switches and instruments:

8 Harris end cell switch indicators, of special design. See Dr. No. 9644.

6 Vertical edgewise voltmeters, 4" frames with the scale range 0-250.

21 Vertical edgewise ammeters, 4" frames with the following scale ranges:

1 ammeter, scale 0-1000 amperes for No. 1 booster motor.

2 ammeters, scale 2,000-0-2,000 amperes for No. 1 booster generators.

2 ammeters, scale 0-3,000 amperes, for motor generators.

12 ammeters, scale 2,000-0-1,000 amperes, for batteries.

4 ammeters, scale 0-1,000 amperes for exciter sets.

6 H. E. A. C. ammeters, scale 0-600, with 5-ampere winding.

8 Bull's-eye indicating lamps with sockets, lamps and plain bull's eyes, for end cell switch motor and Harris indicator circuits.

3 Westinghouse graphic D. C. voltmeters with master clock (voltage range, 150) on battery circuits.

4 Sets of double dial rheostats, for motor-generators, exciters and boosters, consisting of special double dial contact switches and frames as per Dr. No. 13716.

6 D. P. S. T. 25-ampere, 125-volt knife switches with enclosed arc fuses for D. C. feed for "H" switch control.

6 S. P. D. T. controlling switches for "H" oil switch.

18 Bull's-eye sockets and lamps.

6 Red bull's-eyes.

6 Green bull's-eyes.

6 Plain bull's-eyes.

8 Controlling switches, push button type, special design, for operating motors on end cell switches.

6 D. P. S. T. field discharge switches, 250 volts, 200 amperes, for exciters and motor-generators.

2 Hand wheels and special mechanism for operating starting boxes for exciters and motor generators.

2 Starting rheostats, 250 volts, 23 amperes, 1.65 ohms, without overload release.

2 D. P. D. T. knife switches, 500 amperes, 250 volts, for interconnecting starting rheostats.

2 D. P. S. T. 50-ampere knife switches for booster fields.

4 Sets of interlocked starting switches, special design, Dr. No. 16162, for 150-k. w. exciters.

2 Sets of interlocked starting switches, special design, Dr. No. 16161, for 500-k. w. motor generators.

24 Lamp receptacles mounted on two slate panels at back of board for resistance lamps in end cell switch motor circuits.

8 D. P. S. T. 25-ampere, 250 volt, form D switches with type B Noark fuses, ferrule contact, mounted on four panels at back of board for cutting out end cell switch motor and Harris indicators.

II. BUS SECTION.

The bus section of the exciter board consists of three sets of busses on the positive side and three sets on the negative side.

These busses are separated from each other by slate septums, and are supported on the copper studs of the edgewise switches. The panels upon which are mounted switches and instruments shall be of selected slate, blue Vermont marble finish.

The following is the complete list of switches and instruments required for this portion of the board.

Positive Section:

4—2000-ampere edgewise single-circuit battery switches for four busses with 6″ slate base and blue Vermont marble finish, special design Dr. No. 16164.

23—1000-Ampere, edgewise, single-circuit switches for 3 busses with 6″ thick slate base and blue Vermont marble finish for the various circuits on the positive exciter board. Dr. 16163.

11 Vertical edgewise ammeters with single part frame for field circuits, scale 0-500 amperes.

6 Vertical edgewise ammeters with single part frame, scale 0-1500 amperes, for ties.

27 Fuse mountings and fuses on front of board. Drawing No. 17975.

11—500-Ampere shunts and connections to go with 500 ampere ammeters.

6—1500-Ampere shunts and connections to go with 1500 ampere ammeters.

Negative Section:

4—2000-Ampere, edgewise, 1-circuit switches for 4 busses with 6″ slate base and blue Vermont marble finish. Special design Dr. No. 16164.

22—1000-Ampere, 1-circuit edgewise switches for 3 busses with 6″ slate base and blue Vermont marble finish. See Dr. No. 16163.

4 Exciter Circuit breakers (1200-2000) Amp. G. E. Cat. No. 28921, with base. Mounted on back of exciter board.

22 Fuse mountings and fuses for 1000 ampere feeder switches. See Dr. No. 17975.

THE MAIN LIGHT AND POWER BOARD.

The main light and power board shall consist of selected slate panels with blue Vermont marble finish, and for the purposes of these specifications may be divided into two sections,

viz.: 1. The control or starting section; 2. The bus section, positive and negative.

I. THE CONTROL OR STARTING SECTION.

The control or starting section of this board shall have mounted thereon the following complement of switches and instruments:

5 Vertical edgewise ammeters, with 4″ frames and the following scale ranges: 2 ammeters, scale 2000-0-2000 for the booster generators; 1 ammeter, scale 0-1000 for the booster motor; two ammeters, scale 500-0-500, one for the positive side and one for the negative side of the compensator.

1—45-point D. C. sliding contact voltmeter switch, special design, Dr. No. 14736.

1 D. P. D. T. 25-ampere switch to be used in connection with contact switch.

1 D. P. S. T. 25-ampere 250 volt Form D. switch.

2 Special field switches, for compensator fields. See Dr. No. 10897.

2 Rheostats and hand wheels for compensator fields.

2 Rheostats and hand wheels for 36 k. w. Crocker Wheeler Booster.

2 I. P. S. T. 50 Ampere knife switches for booster fields.

1 Special desk and drawer for portable voltmeter.

1—2 Pole neutral battery switch special design Dr. No. 12353.

1—S. P. Neutral battery switch in back of board. Special, see drawing 19490.

II THE BUS SECTION.

The bus section of the main light and power board consists of three sets of busses on the positive side and three sets on the negative side. These busses are separated from each other by slate septums and are supported by the copper studs of the edgewise switches. The following is a complete list of switches and instruments required for this portion of the board.

POSITIVE SECTION:

2—500-K. W. one circuit positive rotary switches for 3 busses, special design. Dr. No. 9027. Bases to have blue Vermont marble finish.

1—1-Circuit starting switch for 3 busses, special design. Dr. No. 9247. Base to have blue Vermont marble finish.

1—2-Circuit battery switch for 4 busses, special design. Dr. No. 10569. Base to have blue Vermont marble finish.

8—4-Circuit long base feeder switch sections. Dr. No. 9199, 7666, 4644. Base to have blue Vermont marble finish.

8—4-Circuit angle contact sections, straight lugs. Dr. No. 7681.

1—2-Circuit booster switch for four busses of special design, see Dr. No. 12852, 12792, 12793, 12850. Base to have blue Vermont marble finish.

32 Vertical Edgewise Ammeters, 3″ frames scales 0-1000.

NEGATIVE SECTION:

2—500-K. W. one circuit negative rotary switches, special design. See Dr. No. 9144. Bases to have blue Vermont marble finish.

1 Two circuit battery switch for four busses of special design. Dr. No. 10569. Base to have blue Vermont marble finish.

1 Two circuit booster switch for four busses of special design. Base to have blue Vermont marble finish. Dr. Nos. 12852, 12792, 12793, 12850.

8 Four circuit long base feeder switch sections, see Dr. Nos. 9199, 7666, 4644. Bases to have blue Vermont marble finish.

8—4-circuit angle contact sections straight lugs, special Dr. No. 7681.

In addition to the above, there shall be installed on the separate slate panels, blue Vermont marble finish, one 3-pole battery neutral switch of special design. See drawing 16404. This panel is to be located on north division wall of building.

SPECIFICATIONS

Accompanied by drawings for the

Motor Generators and Exciter Sets.

of the New Waterside Power Station.

To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York, Being part of Contract dated February 4, 1907, between the Westinghouse Electric & Manufacturing Company, Contractors, and The New York Edison Company.

GENERAL :

The Contractor agrees to furnish f. o. b. cars point of shipment electrical apparatus and appliances as specified below:

Two (2) 500 K. W motor generator sets 485 R. P. M. with mechanical oscillator, two-bearings, each set consisting of the following apparatus:

One 750 H. P. three phase, 6300 volt, 25 cycle motor with rheostat upon shaft and rotating switch to cut out starting resistance, direct connected to and mounted upon common base and shaft with 500 K. W. D. C. shunt wound, 270 volt generator with field rheostat.

Four 150 K. W. motor generator sets to be used as exciters, each consisting of

One 150 K. W. generator, shunt wound, 280 volts D. C., and one 220 H. P. type "C" motor 6,300 volts, three phase, 25 cycle.

The 500 K. W. motor generators will be built in accordance with the following detailed specifications hereto attached and forming part of this agreement.

SPECIFICATION FOR 500 K. W. MOTOR GENERATOR SETS.

These sets will each be made up of one 500 K. W., 485 R. P. M., 240-300 volt, shunt wound, direct current generator, direct connected to a 750 H. P. (one 6,000 and the other 6,300 volts) 25 cycle, three phase induction motor. These machines will be mounted upon common cast iron base and shaft with two bearings.

The outfit will be complete with a mechanical end play device.

The direct current generator will have a range of two hundred and forty to three hundred volts and normal capacity of 1850 amperes at 270 volts.,

After a full load run of twenty-four hours, no part of the complete outfit will show a temperature rise exceeding 40° Centigrade above the surrounding air at 25° Centigrade, except the commutator of the direct current generator may rise 45° C.

After a run of 125% load for two hours immediately succeeding the full load run, no part of the combined outfit will have a temperature rise exceeding 50° Centigrade. Temperature to be measured by a thermometer.

EFFICIENCY:

The D. C. generator will have the following efficiency:

50%	load	90½%
75%	"	92%
Full	"	92½%
1¼	"	92%

The induction motor will have the following efficiency:

50%	load	90
75%	"	91
Full	"	91½
1¼	"	90

These efficiencies are based on I^2R losses in armature and field, armature iron loss and friction. The losses are to be determined separately.

POWER FACTOR:

The power factor of the induction motor will be:

50%	load	81½
75%	"	85½
Full	"	87½
1¼	"	88½

The induction motor will be equipped with a starting rheostat mounted upon the spider of the rotor with the suitable rotating switch to be used to cut the starting resistance and finally short circuit the secondary winding.

WEIGHT:

The total net weight of the above outfit will be approximately 56,000 lbs.

The overall dimensions will be approximately 8′ 1″ wide by 13′ 6″ long over shaft by 7′ 12″ over "I" bolts.

SPECIFICATION FOR 150 K. W. EXCITER SET

DIRECT CURRENT GENERATOR.

Shunt wound Engine type 150 K. W.

Speed 485, E. M. F. 280 Poles 8.

GENERAL:

This generator is to be of the so-called "Engine Type" the armature and commutator being built together upon a ventilated cast iron sleeve and arranged to be pressed on the shaft. The field castings will be divided in a vertical plane and be on the same bed plate with the A. C. Motor. The generator will be furnished with a brush holder and means of adjusting same.

Rating:

This machine is rated at 535 amperes at 280 volts at a speed of 485 revolutions per minute.

Efficiency:

The generator will have an efficiency of not less than 80 per cent. at one-quarter load; 88 per cent. at one-half load; 91 per cent. at three-quarter load and 91.5 per cent. at full load.

Operation:

The brushes having been once adjusted there will be practically no sparking due to variations of the load within the limits of no load and 25 per cent. over load. The machine will run at full load for 24 hours with practically no sparking or burning of the brushes, and without blackening the commutator. It will not be necessary to shift the position of the brushes if the load be increased from no load to 25 per cent. over load, nor will there be serious sparking if the load be increased temporarily to 50 per cent. over load. If the current in the shunt field be adjusted so that the voltage of the machine at no load is ...., a load of .... amperes, at such increase of voltage as will be maintained by the combined shunt and series field current, may be temporarily carried on the machine, and if, with this current in the main circuit, the circuit breaker be opened, the machine will not buck and no serious sparking at the commutator will occur.

Temperature:

The machine will be able to operate 24 hours at full rated load, with a rise in temperature of any part not to exceed 40 degrees Centigrade above the surrounding atmosphere. It will also carry an over load of 50 per cent. following the above full load test for a period of one hour, with an ultimate rise in temperature above the surrounding atmosphere not to exceed 60 degrees Centigrade. It will also carry momentarily

an over load of 75 per cent. without injurious heating. The temperature in each case to be measured by thermometer method. Machine will also be capable of giving 200-k. w. at from 200 to 280 volts for 3 hours, temperature rise not to exceed 40° C.

REGULATION:

The field of the machine will be shunt wound for 200 to 280 volts.

FIELD FRAME:

The field frame will be made of best quality of cast iron, sound and free from blow holes; the pole pieces will be laminated steel, the pole pieces and field windings being so proportioned as to reduce the distortion due to armature reaction to the lowest possible limit.

FIELD COILS:

The shunt and series coils will be separately insulated and so held in position as to admit of thorough ventilation. The insulation of the coils will consist of several layers of fibrous material thoroughly protected by canvas, which is in turn protected by a large number of turns of rope. This insulation will be substantial and permanent, not to absorb moisture. The insulation of the complete coils will be capable of successfully withstanding an alternating current of 1500 volts potential. The field coils will be painted with a water and oil proof compound.

ARMATURE:

The armature will be the slotted drum type. It will have a multiple winding so arranged that the circuits will not become unbalanced with the displacement of the armature as much as 1/32″ from the geometric center of the fields, and when so displaced there will be no injurious sparking at the brushes, no vibration in the armature, and from each brush

holder arm will be drawn approximately its pro rata share of current. The armature core will be built up of laminated sheet steel of the highest magnetic quality. Laminations will be placed upon the cast iron spider; the sheet of steel will be keyed accurately to the spider; the laminated core thus built up will be held firmly between two end plates. The armature winding will consist of copper bars approximately rectangular in section, formed into coils without joints and will be insulated before being placed in slots. The coils will be held in slots by retaining wedges of hard fibre. There will be no bands on the armature.

The insulation of the armature conductors will consist of sheet material of high insulating quality applied in over-lapping layers. This will be held in place with tape, and the whole will be treated with a weather proof, oil proof compound. The material and workmanship will be of the highest grade. The insulation of the complete armature will withstand a test of 1500 volts alternating E. M. F.

COMMUTATOR:

The commutator will be made of bars of hard drawn copper, insulated from each other by mica not more than 1/32" thick. The number of bars will be such that with an electromotive force of 280 volts on the machine the average difference of potenntial between two bars will not exceed 7 volts. The proportions of mica and copper will be such that the two will wear at the same rate. The commutator bars will be held in position at one end by a cast iron ring with a V section. This ring will be cast with the armature spider. The other and opposite end of the commutator bars will be supported by segments of same section, firmly held in position by bolts of ample strength. These segments will be so arranged that one or more bars may be removed from the commutator without disconnecting other bars. The armature winding will be thoroughly soldered to the necks of the commutator bars; the joints will be made in a workmanlike manner, and show no traces of free solder and will have a greater carrying capacity

than the armature conductor. The neck of the commutator bar will be of hard rolled copper, riveted and brazed to the commutator bar. These necks will be rigid and will not require additional support.

BRUSHES:

The arms carrying the brushes will be strong and rigid. They will be supported from a ring accurately fitted to the yoke, which may be shifted for adjusting the brushes by hand wheel or worm gear. This method of supporting the brushes leaves the commutator clear and comparatively free of obstruction and open for inspection. The brushes will be of carbon. The brush holder will be of the sliding shunt type. The brushes will be of such size and number to carry the full load current of the machine continuously, without undue heating, and a 50 per cent. overload for two hours without injurious heating. The normal current density in the carbon brushes when operating, at full load will be about 30 amperes per square inch.

VENTILATION:

Throughout the armature, spider, core and the windings, large and open ventilating ducts will be provided. The design of the spider will be such as to set up a forced circulation of air through these ventilating spaces. Space will also be left between the shunt and series coils so that a free circulation of air may be maintained while the machine is in operation.

INDUCTION MOTOR.

220 H. P. E. M. F. 6,600 volts; speed 485; poles 6; 25 cycles.

GENERAL DESCRIPTION:

This motor will be Westinghouse type "C" with rotating secondary, the rotating part being built upon a cast spider. The external frame will not be divided. It will consist of a

cylindrical yoke to which will be bolted circular end shields. The motor will be mounted upon the same bedplate with a D. C. generator.

NORMAL RATING:

The normal output will be 220 H. P. at approximately 485 revolutions per minute when supplied by a three phase circuit of 25 cycles per second delivering 6,600 volts at the motor terminals.

SPEED REGULATION:

The motor will be wound for 6 poles and when operated at 6,600 volts and 25 cycles will run approximately 500 revolutions per minute, no load, and the speed will fall to approximately 485 revolutions per minute when the rated load of 220 H. P. is thrown on. For intermediate loads and loads up to 50 per cent. above the rated load, the drop in the speed or slip will be practically in proportion to the load.

EFFICIENCY:

At 6.600 volts and 25 cycles the motor will have an efficiency of not less than 89 per cent. at one-half load, 89.5 per cent, at three-quarters load, and 90 per cent. at 220 horse power. These efficiencies are based on I^2R losses in the primary and secondary, iron losses, friction and windage. These losses to be determined separately.

CURRENT AND POWER FACTION:

At 6,600 volts and 25 cycles the motor will require 17.4 amperes per terminal for its rated load of 220 H. P. developed. At 6,600 volts and 25 cycles, the motor will have a power factor of not less than 82 per cent. at one-half load, 89 per cent. at three-quarters load and 92 per cent. at full load of 220 H. P.

TEMPERATURE:

The machine will carry a normal load of 220 H. P. for 24 hours at 6,600 volts and 25 cycles, with a rise in temperature in no part to exceed 40 degrees Centigrade; and at 25 per cent. overload for 24 hours the rise in the temperature will not exceed 50 degrees Centigrade; and at 50 per cent. overload for one hour the rise in temperature will not exceed 60 degrees Centigrade. Temperature to be measured with a thermometer. The motor will be able to start and bring to speed the generator when unloaded.

PRIMARY:

The primary frame will be made of the best quality of cast iron, sound and free from blow holes. The magnetic circuit will be of laminated steel, and the proportions will be such that the self induction will be reduced to a low value.

The primary coils will be wire wound, and will be arranged for good ventilation. The insulation of the primary coils will consist of sheet material of high insulating quality, applied in over-lapping layers. This will be held in place by tape and the whole will be treated with a moisture and oil proof compound. After completion, the insulation of the entire primary winding from the frame will be subjected to a puncture test of 1,500 volts alternating E. M. F.

SECONDARY:

The secondary will be the slotted drum type. The core will be built of laminated steel, the laminations will be dovetailed to the cast iron spider. The laminated core thus built will be held firmly between two end plates. The secondary winding will consist of straight copper bars of rectangular section, insulated before being placed in slots. The bars will be held in the slots by overhanging tips of teeth. There will be no bands in the secondary. Supported at each end of the secondary core will be a secondary ring of ample section, to which the end of the secondary bar will be bolted, the con-

nection of the bars to the rings will be such that they will not be affected by the change of the temperature.

VENTILATION:

Throughout the entire machine large and open ventilating spaces will be provided. The design of the spider and the secondary rings will be such as to set up a forced circulation of air through these ventilating spaces. Space will be left also between the primary coils so that the free circulation of air may be maintained while the machine is in operation.

SPECIFICATIONS FOR BOOSTER.

The Contractor further proposes to furnish F. O. B. cars, New York, the following:

1—36-k. w. Crocker-Wheeler booster consisting of:

1—110-H. P. motor, 750 R. P. M. at 240 volts and

2—36-k. w. generators, output, 36 k. w., at 750 R. P. M. Volts 60.

1—75-k. w. Northern Electric Company compensator consisting of:

2—75-k. w. shunt wound D. C. generators, speed 600 R. P. M., volts 125 to 150 together with shunt field resistance and starting rheostat with underload and overload attachment.

SPECIFICATIONS

Accompanied by drawings for the

Turbine Signals to be Installed

in the New Waterside Power Station.

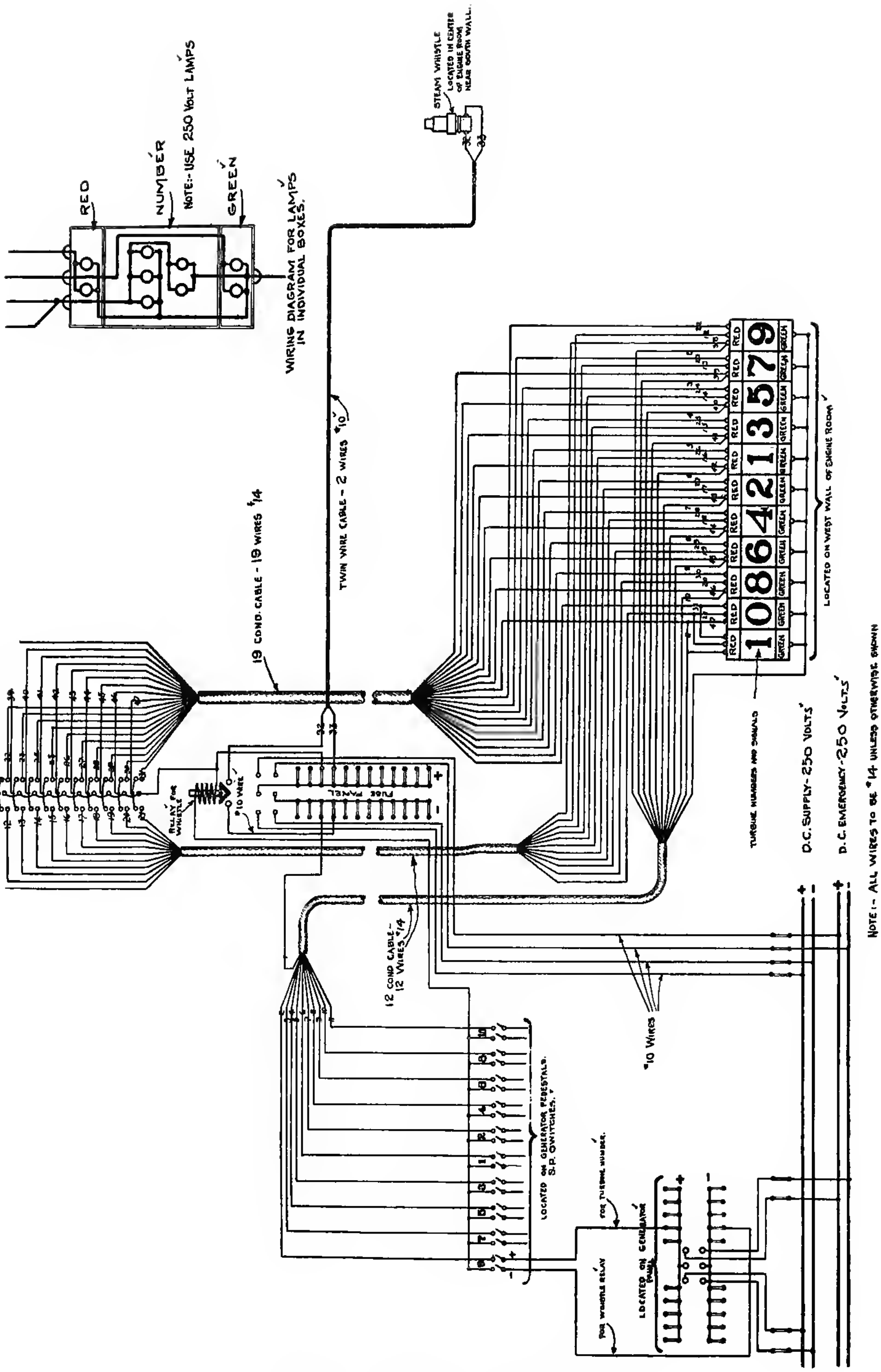
To be erected on a property bounded on the North by 40th Street, on the South by 39th Street, on the West by 1st Avenue, and on the East by East River, Borough of Manhattan, City of New York. Being a description of certain apparatus designed and installed by The New York Edison Company for use as a means of transmitting signals between the operators on the high and low tension switchboards and the engineer stationed at the turbine throttle.

GENERAL:

In general these specifications cover three distinct methods of transmitting signals:

1st. Signals relating to the governing of the turbines, and transmitted through the illuminated sign located on west wall of engine room, and used in conjunction with the signal whistle located on south division wall.

2nd. Signals relating to the starting or stopping of the turbines and transmitted to the engineer direct through the signal stand located near the turbine throttle.



WIRING DIAGRAM SIGNAL SYSTEM.

3rd. A call signal whistle from the D. C. control board, on the 1st floor electrical gallery.

I. SIGNALS FOR REGULATING GOVERNOR.

The general arrangement of apparatus and connections for signals for regulating the turbine governors is indicated in Dr. No. 16980. "Wiring diagram for turbine numbers, signals and whistle."

The following is a complete list of apparatus required.

20 S. P. S. T. Special signal switches with reversed etched name plates, see detailed drawing of switch 16692; located on the front of generator pedestals, (two for each pedestal) for operating whistle relay and flashing turbine number.

10 S. P. D. T. knife switches located on top of pedestal under synchroscope panel. For detail of switch, see Dr. No. 19210, for location of switches, see Dr. No. 15732.

With these switches may be flashed individually the turbine number and the red or green engine signal of the illuminated sign.

1 D. P. D. T. 25 Amp. Form D. Knife switch together with special copper strap connection and 24 sets of H. W. Johns Manville Co.'s ferule type inclosed arc fuses and clips, forming the D. C. fuse panel on front of pedestal under synchroscope.

1 Special relay oil switch with lever for hand operation, as indicated in drawing No. 18095 and located on top of center pedestal of generator control board under synchroscope panel.

The magnet for this relay is to be wound with 1,800 turns of No. 26-double cotton covered magnet wire, about 738 feet in all.

1 "di-el-ite" resistance unit of 465 ohms 116 watts for external resistance in relay oil circuit.

1 Magnet on 250-volt circuit, of sufficient pull to operate a 3½" steam signal whistle. This magnet is located near the whistle on south division wall in engine room.

1 Illuminated sign for turbine numbers and engine signals as indicated in assembly drawing No. 16892 and located on west wall of engine room.

This sign consists of a substantial sheet iron box with angle iron frame work set flush with engine room wall, and displaying the stenciled turbine numbers from one to ten inclusive.

Above each numeral shall be a separate ground glass signal panel to indicate red for "raise" and below a similar signal panel, indicating green for "lower," as the case may be.

Within this sheet iron box are the lamps and circuits for illuminating the turbine numbers and colored signals mentioned.

The whole to be constructed in accordance with the detailed drawings furnished by the company and forming part of these specifications.

For connecting up this device there will be required the following cables.

2—12-conductor No. 14 wire lead covered cables approximately 30 feet long. There shall be 2/32" rubber over each wire, two tapes and 5/64" lead over all.

1—19-conductor No. 14 wire lead covered cable, approximately 30 feet long, having wire 2/32" rubber, two tapes and 5/64 lead.

1 Twin wire cable lead covered, consisting of two No. 10 wires each wire to have 5/64" rubber and 1/16" lead, over both.

When the above specified apparatus is connected up in the manner indicated in the diagram, it is expected that the operator at any one of the generator pedestals shall be able to blow the signal whistle and flash the turbine number; also that he may from the center pedestal be able to blow the signal whistle and flash either the red or green signal together with any of its corresponding turbine numbers.

This signal is to be constructed in accordance with assembly drawing No. 17358.

II. SIGNAL TO START OR STOP TURBINES:

The wiring diagram for connecting up the apparatus used for signaling the engineers to start up or shut down the turbines is included in the "Wiring" diagram of H. T. generator control pedestals 25 cycles and 60 cycles, drawings No. 16057 and No. 17343.

The following is a complete list of the apparatus required:

30 S. P. S. T. Special signal switches with reversed etched name plates. (see drawing 16692) located on the front of generator pedestals, 3 for each pedestal, together with three plain signal lamps and receptacles. The name plates are to be labeled resepctively: "Start," "Stand by," "Load off."

10 Special signal devices, (see Dr. No. 17112) mounted on front of generator instrument panels, one for each panel, and each consisting of special malleable iron box, of dark marine finish to match finish of instruments on panel; a ground glass face on which shall be painted in 1/2" block letters the three signals; "Full Speed," "OK," "Shut Down."

Each of these outfits to contain 6 miniature frosted lamps and screw bases.

8 Turbine signal devices on stands complete, (see drawing No. 17357) each consisting of 1 1/4" iron pipe stand, and special cast iron front with oxidized bronze finish and mounting the following:

1 H. E. frequency indicator.

1 Engine signal device consisting of malleable iron box, oxidized bronze finish, ground glass face on which shall be painted in half inch block letters the signals, "Stand by," "Start," "Load off," "Full Speed," "OK," "Shut Down" to be illuminated by 12 miniature frosted lamps with screw bases.

1 gang of three signal knife switches, see Dr. No. 17359 enclosed in a cast iron box, oxidized bronze finish.

2 Turbine signal devices similar to above except that they are to be mounted on west wall of engine room, and each to have in addition to above a frequency indicator for the 60 cycle generator.

For connecting up this apparatus the following cables will be required.

10—19-conductor No. 14 wire control cables, one for each turbine signal, and of various lengths.

All these devices shall be constructed in accordance with detailed drawings and sketches furnished by the Company and forming part of these specifications.

With the above apparatus it shall be possible for the operator at the H. T. generator control pedestal to flash the following signals to the engineer standing at the turbine throttle: "Start," "Stand by," "Load off" and to receive in turn signals from the engineer as follows: "Full Speed," "OK," "Shut Down."

III. CALL WHISTLE FROM EXCITER BOARD.

For operating the call whistle there shall be installed on the exciter board:

1 Mechanically operated oil switch of special design as shown on assembly drawing No. 18471;

There shall be installed on the south division wall, near the call whistle,

1 Magnet operating on 250 volt circuit capable of developing about 50 lbs. pull and so arranged as to blow the 2½" call whistle.

For location and arrangement of whistle see drawing No. 17569.

LIST OF DRAWINGS

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